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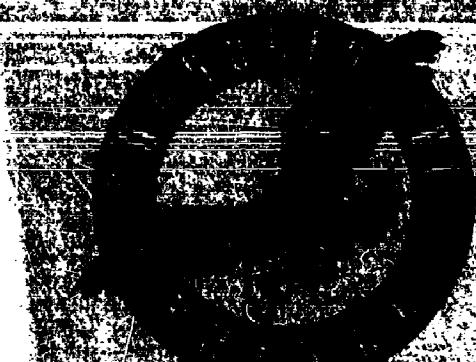
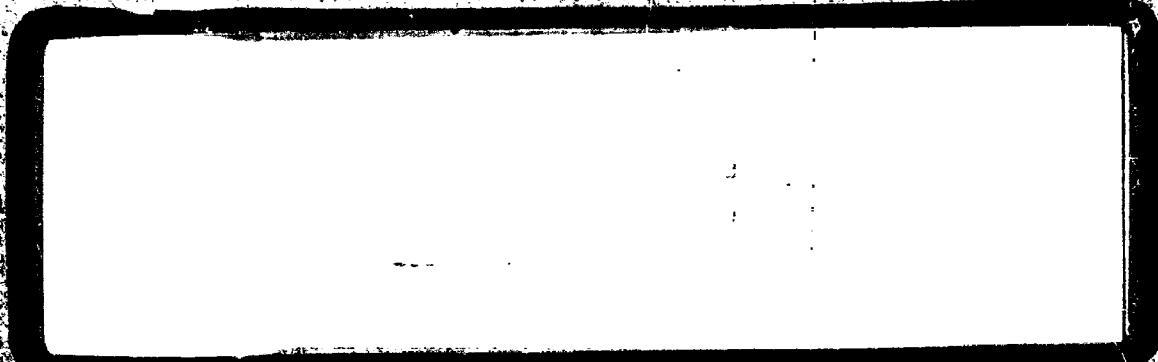
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CONSOLIDATED VULTEE AIRCRAFT CORPORATION  
FORT WORTH DIVISION • FORT WORTH 1, TEXAS



156  
165

**MODEL XB-36**

REPORT FZS-36-242

DATE May 1948

**TITLE**

## STRESS ANALYSIS OF WING CENTER SECTION

### PART III

## INTERSPAR BULKHEADS

## LEADING AND TRAILING EDGE STRUCTURE

**SUBMITTED UNDER**

Contract W535-ac-22352

and

ACA 269A

**PREPARED BY:** A. L. Canfield  
G.R. Cawthon, Jr.  
M. Fawcett

**GROUP: STRUCTURES**

**CHECKED BY:** J.W. Johnson

#### **REFERENCE:**

D BY M.C. Robbins  
W.H. Whistler

**NO. OF PAGES** 306

**NO. OF DIAGRAMS** 26

## **REVISIONS**

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CONSOLIDATED VULTEE AIRCRAFT CORP., FORT WORTH DIV.,  
TEX. (REPORT NO. FZS-36-242)

**STRESS ANALYSIS OF WING CENTER SECTION - PART III - INTERSPAR  
BULKHEADS - LEADING AND TRAILING EDGE STRUCTURE - MODEL XB-36**

N.S. MEFFORD; B.C. VOSS; A.B. CANFIELD AND OTHERS  
MAY '48 306PP. TABLES, GRAPHS

USAF CONTR. NO. W535-AC-22352

**STRUCTURES (7)**      **WINGS - STRESS ANALYSIS**  
**DESIGN AND DETAILS (3)**      **B-36 - STRESS ANALYSIS**  
                                    **B-36**

ANALYSIS Wing  
PREPARED BY Mefford  
CHECKED BY Johnson  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

PAGE 1  
REPORT NO. FZS-36-242  
MODEL XB-36  
DATE 5-18-48

ANALYSIS OF WING INTERSPAR BULKHEADS

LEADING EDGE, AND TRAILING EDGE

GENERAL INTRODUCTION

The purpose of this report is to analyze the center section wing box bulkheads, the trailing edge and the leading edge of the XB-36 Airplane. Due to the similarity of the B-36 and the XB-36 wing the YB-36 and B-36A Bulkhead Analysis, Report FZS-36-142 will be used as a guide in the preparation of many sections of this report.

The design conditions are based on the XB-36 with the one wheel main landing gear except for the landing gear bulkheads (5, 7, 8, and 9) and the in-board section of the wing trailing edge which are analyzed using loads obtained with the XB-36 four wheel main landing gear. Ref. ACA 269A.

The minimum margins of safety for the structure (wing bulkheads, trailing edge and leading edge) analyzed in this report appear on page 2.

ANALYSIS WING  
PREPARED BY Zifford  
CHECKED BY Johmson  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

PAGE 2  
REPORT NO. FZS-36-242  
MODEL XB-36  
DATE 5/48

TABLE OF MINIMUM MARGINS  
OF SAFETY

TABLE I

MEMBER	DESCRIPTION AND LOCATION	MIN MS.	PAGE
BLKHD 0	-11 STIFFENER	+003	16
BLKHD 10	NO MARGINS OF SAFETY SHOWN		22
BLKHD 3	CENTER DIAGONAL TUBE (MN)	+32	47
BLKHD 13	RIVET ATTACHMENT FWD VERTICAL TRUSS TUBE (NO)	+06	88
BLKHD 19	END CONNECTION CENTER DIAGONAL TUBE (OP)	+03	129
BLKHD 11	-15 STIFFENER	+06	166
BLKHD 18	UPPER CHORD	+10	191
BLKHD 16	UPPER CHORD	+83	199
BLKHD 22	SECOND STIFFENER WEB SPLICE, FORWARD REAR SPOR	+55	214
BLKHD 23	FWD VERTICAL TRUSS TUBE (NO)	.00	261
BLKHD .5	-59 WEB	+05	286
BLKHD 7	STIFFENERS	+01	286
BLKHD 8	DIAGONAL TRUSS TUBE END CONNECTION (36W4108-11B)	+055	287
BLKHD 9	-7 WEB	+032	287
T.E. IN 80 CIN NO.	WEB SPLICE 52 1/2% BEAM	+035	293
T.E. OUT 80 CIN NO.	MEMBER C-1 T.E. RIB #13	0	305
LEADING EDGE	DIAGONAL TUBE STA 127.16	+045	306

ANALYSIS WING  
PREPARED BY M. J. Mafford  
CHECKED BY J. L. Johnson  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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MODEL XB-36  
DATE 5 - 48

WING CENTER SECTION

BULKHEAD ANALYSIS

INTRODUCTION

The wing center section bulkheads are of the following type of construction:

1. Web type (semi-tension field)
2. Truss type
3. Combined web-truss type

Typical critical bulkheads of all types are analyzed either completely or by comparison with the B-36A analysis. Bulkheads #3 and #13 are typical truss type airload bulkheads. Bulkhead #19 is a typical truss type flap load bulkhead. Bulkheads #11, #16, #18, #22 and #23 are typical fuel wall, engine mount support and jack point bulkheads. Bulkheads #5, #7, #8 and #9 are landing gear support bulkheads. Bulkhead #0 and #10 require a special analysis due to the nature of their loading.

The chordwise airload distribution for bulkheads 3, 13, 19, 22 and 23 are tabulated on pages 6 through 10, while air loads for bulkheads 10, 11 and 18 are obtained from B-36A data. The upper and lower surface chordwise pressure distribution values are obtained from Figures 1.1 through 1.8, pages I-12 FZS-36-142. A detailed explanation of the chordwise pressure distribution calculations is given on page I-7 of FZS-36-142.

The properties of the various materials used in the wing structure are obtained from C.V.A.C. Structures Bulletins B-1, B-2, B-3, and from ANC-5.

The column allowables for truss tubes are obtained from page I-61, FZS-36-142.

The bulkhead loads due to the LAA and ILAA minimum flying weight conditions will be larger for the XB-36 than for the B-36A. The gust criteria used in the two airplanes is not the same.

$$B-36A, n_{(LAA)} = 1 + \frac{5K_1 aV}{W/S} \sigma^{-\frac{1}{2}}$$

$$XB-36, n_{(LAA)} = 1 + \frac{3K_1 aV}{W/S} \sigma^{-\frac{1}{2}}$$

ANALYSIS WING  
PREPARED BY McLeod  
CHECKED BY J. L. L.  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
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FORT WORTH, TEXAS

PAGE 1  
REPORT NO. FZS-36-242  
MODEL XB-36  
DATE 5 - 48

where  $K = 2K_1$

at the 5,000' level

$$\sigma = .8616 , \quad \sigma^{\frac{1}{2}} = .9285$$

then

$$B-36A, n_{(LAA)} = 1 + \frac{5K_1 aV \times .9285}{W/S}$$

$$XB-36, n_{(LAA)} = 1 + \frac{6K_1 aV \times .8616}{W/S}$$

This gives an increase of factor for the XB-36 in the LAA condition of approximately 8% for the same speed and G.W.

Bulkhead loads imposed by landing loads are directly proportional to the landing gross weight, therefore, the bulkhead loads for the XB-36 DGW landing condition will be  $\frac{(255,000)}{268,000} = .95$  of the B-36 loads.

TABLE II DATA FOR CHORDWISE AIR LOAD DISTRIBUTION  
XB-36 AIRPLANE

PAGE 5  
F25-36-242  
XB-36  
5/48

BLK NO	STATION	DESIGN CONDITION	1	2	3	4	5	6	7	8	9	10	11	
			M	V	LIMIT	$\beta$	$C_L$	$C_{Lm}$	$C_{L0}$	$C_{Lx} \times C_{Lm}$	$C_L$			
			MACH NO		(REF: F25-36-126)		(REF: F25-36-128)		( $\beta \times \theta$ )	( $\theta + \beta \theta$ )				
3	113.25	DGW LAA @ 5000'	.416	311	213.1	-424	.939	.0258	-398	.73722				
		AGW(72-1000B) LAA @ 5000'	.387	214.8	101.7	1.500	.939	.0258	1.408	1.4338				
		AGW(72-1000B) LAA @ 5000'	.416	311	213.1	.702	.939	.0258	.706	.7318				
13	412	DGW LAA @ 5000'	.416	311	213.1	.7531	.995	.0180	.749	.767				
		DGW LAA @ 5000'	.416	311	213.1	-4240	.995	.0180	-422	-404				
		RGW(72-1000B) LAA @ 5000'	.416	311	213.1	.7058	.995	.0180	.703	.721				
19	615.38	DGW FDGE @ SEA LEVEL	.247	188	90.41	1.3395	1.027	.3440	1.374	1.718				
		EGW(72-1000B) FDGE @ SL.	.247	188	90.41	1.2369	1.027	.3440	1.270	1.614				
22	732	DGW FDGE @ SEA LEVEL	.247	188	90.41	1.3395	1.042	.3280	1.395	1.723				
23	766	MFW LAA @ 5000'	.416	311	213.1	.5690	1.048	-.0065	.596	.5895				
		MFW LAA @ 5000'	.416	311	213.1	-2792	1.048	-.0065	.286	.25425				
		DGW LAA @ 50000'	.597	396	124.27	1.1857	1.048	-.0065	1.242	1.2335				

RECORDED BY  
Sgt J. H. Miller  
CHIEF OF STAFF  
ARMED FORCES  
INSTITUTE

TABLE II

DOC NO  
F25-36-242  
XB-36

TABLE III CHORDWISE AIRLOAD DISTRIBUTION  
XB-51 FLYING BULKHEADS

MADE TO REPORT NO. 5000  
DATE

X/ %	DESIGN GROSS WEIGHT 14,441 @ 5000'				AGILE 14,000 DESIGN LOAD 5000' AGILE 14,200 DESIGN LOAD 5000'				
	Cg = .3722	LMT A = 2131	Cg = .3736	LMT B = 1812	Cg = .3736	LMT B = 2131			
	(Pb) O.P. P.M.	O.P. P.M.	(Pb) O.P. P.M.	(Pb) O.P. P.M.	(Pb) O.P. P.M.	(Pb) O.P. P.M.	(Pb) O.P. P.M.	(Pb) O.P. P.M.	
	1.05 36.142	1.05 36.142	1.05 36.142	1.05 36.142	1.05 36.142	1.05 36.142	1.05 36.142	1.05 36.142	
0	1.03 103	214 219	0	1.00 1100	1101.7 1101.7	0	1.03 103	214 219	0
.005	.97 -73	207 -156	+363	-3.02 11.00	-307 1101.7	-409 -.49	.83 -104	+177 -281	
.010	.88 -1.06	188 -226	+414	-3.02 11.00	-307 1101.7	-409 -.59	.74 -126	158 -284	
.025	.68 -1.36	145 -290	+435	-3.00 4.96	-305 +98	-403 -.82	.48 -175	102 -211	
.050	.44 -1.36	94 -290	+384	-2.73 4.87	-378 +88	-366 -1.03	.24 -219	+51 -270	
.10	.08 -1.43	17 -362	+279	-2.32 1.64	-336 +65	-301 -1.24	-.01 -214	-2 -262	
.20	-35 -1.12	-75 -239	+164	-2.04 1.30	-208 +31	-239 -1.37	-24 -292	-57 -241	
.30	-54 -915 -115	-208 +93		-1.77 4.13	-180 +13	-193 -1.34	-36 -286	-77 -209	
.40	-57 -377 -121	-164 +43		-1.38 4.07	-140 +7	-147 -1.15	-30 -245	-64 -181	
.50	-445 -50 -103	-107 +4		-1.03 4.08	-105 +8	-113 -.90	-18 -192	-38 -154	
.60	-135 -28 -75 -60	-150		-0.68 4.10	-69 +10	-79 -63 -0.4	-134 -9	-125	
.70	-19 -11 -40 -23	-17		-0.41 4.13	-42 +13	-53 -39 1.04	-13 -13	+9 -92	
.80	-0.45 364	-10 +9	-19	-0.18 4.22	-18 +22	-60 -14 4.16	-30 34	-64	
.90	1.10 3.24	1.21 1.51	-30	1.03 4.32	1.3 1.33	-30 +10 1.09	1.21 1.62	-41	
1.00	1.24 1.24	1.51 1.01	0	1.21 1.21	1.21 1.21	0 +1.24 1.24	+51 +51	0	

\* REF. TABLE II R5

BY M. H. HODGE  
checked by C. J. New

X/C	DESIGN GROSS WEIGHT @ 5000' L.A.A.			DESIGN GROSS WEIGHT @ 5000' L.L.A.A.			R.G.W. (72:1000 BOMBS) @ 5000' L.A.A.		
	$C_L = +1.67$	LIMIT 4 = 213.1 /%0	$C_L = -1.04$	LIMIT 5 = 213.1 /%0	$C_L = +7.21$	LIMIT 3 = 213.1 /%0	$(AP/L)$	$(AP/L)$	$(AP/L)$
	$(AP/L)$	$\Delta PU$	$\Delta PL$	$\Delta NET$	$(AP/L)$	$\Delta PU$	$\Delta PL$	$\Delta NET$	$(AP/L)$
	$+28.36-10.2$				$FES-34-142$				$FES-34-142$
	P.I-16 P.I-17				P.I-16 P.I-17				P.I-16 P.I-17
0	+1.03 +1.03	+219.5 +219.5	0	+1.03 +1.03	+219.5 +219.5	0	+1.03 +1.03	+219.5 +219.5	0
.005	- .565 + .860	-120.4 +183.3 -303.7	+280 -810 +208.7 -172.5 +381.2 -445 +820 -94.8 +174.7 -269.5						
.010	- .660 + .770	-140.6 +164.1 -304.7	+294 -1150 +190.4 -245.0 +435.4 -555 +720 -118.3 +153.4 -271.7						
.025	- .880 + .515	-187.5 +109.7 -297.2	+707 -1430 +150.6 -304.6 +455.2 -790 +455 -168.3 +37.0 -265.3						
.050	-1.090 + .280	-232.3 +59.7 -294.0	+475 -1.410 +101.1 -300.5 +401.6 -1.000 +223 -2.3.1 +47.9 -261.0						
.10	-1.285 + .015	-273.8 + 3.2 -277.0	+100 -1.265 +213 -269.6 +299 -1.210 -0.25 -257.8 -5.3 -252.5						
.20	-1.420 -220	-302.6 -46.9 -255.7	-330 -1.140 -70.3 -242.8 +172.5 -1.360 -250 -283.8 -53.3 -236.5						
.30	-1.370 -340	-291.5 -72.5 -219.4	-515 -99.0 -109.7 -211.0 +101.3 -1.330 -345 -283.4 -77.8 -205.6						
.40	-1.170 -280	-249.5 -59.7 -189.4	-550 -730 -117.1 -166.2 +421 -1.140 -305 -242.9 -65.0 -177.9						
.50	- .995 -1.05	-192.9 -35.2 -67.7	-475 -510 -101.2 -108.7 +7.5 -1.885 -183 -182.6 -39.2 -143.6						
.60	- .635 -0.85	-135.3 -7.5 -127.8	-340 -290 -72.5 -61.8 -10.7 -625 -0.42 -133.2 -8.9 -124.3						
.70	- .390 +0.45	-83.1 +9.6 -92.7	-190 -114 -40.5 -24.3 -16.2 -384 +0.55 -81.8 +7.5 -89.3						
.80	- .140 +1.60	-29.8 +34.1 -62.9	-0.040 +0.035 -3.5 +7.5 -16.0 -1.140 +1.60 -23.8 +34.1 -63.3						
.90	+ .075 +2.40	+16.0 +61.8 -43.8	+105 +240 +22.4 +51.1 -28.7 +0.080 +2.86 +17.0 +60.9 -43.8						
1.00	+ .240 +2.40	+51.1 +51.1 0	+240 +240 +51.1 +51.1 0 +.240 +240 +51.1 +51.1 0						

\* REF TABLE II P-5

CALC. BY: *B. C. Clegg*  
CHkd. BY: *B. C. Clegg*

CONSOLIDATED VULTEE AIRCRAFT CORPORATION

PORT WORTH DIVISION PORT WORTH, TEXAS

PW 823 125 PADS 11-43

TABLE II CHOSENWISE AIRLOAD  
DISTRIBUTION - BWHD #13Page 1  
Pilot No. PBS-36-043  
Model XB-51

X	DESIGN GROSS WEIGHT, FOL. GE SPANNED	R.C.W. - 1/2 1000# BOMBS) FOL. GE SPANNED	DATE 10-43
C	* C <sub>2</sub> = 1.718 * LIMIT g = 90.41% H	* C <sub>2</sub> = 1.614 * LIMIT g = 90.41% H	
( $\Delta P_1$ ) <sub>u</sub>	( $\Delta P_1$ ) <sub>u</sub> $\Delta P_u$ $\Delta P_L$ PER %	( $\Delta P_1$ ) <sub>u</sub> ( $\Delta P_1$ ) <sub>u</sub> $\Delta P_u$ $\Delta P_L$ PER %	
$P_{15-50} - 142$ $0.148 \text{ PLD}$			
0 + .98 +1.00 +89	+90 -1	+1.00 +1.00 +90 +90 0	
.005 -1.20 +1.00 -108	+90 -198	-.82 +1.00 -74 +90 -164	
.01 -1.89 +1.00 -116	+90 -206	-.93 +93 -84 +89 -173	
.025 -1.45 +.74 -131	+67 -198	-1.15 +.64 -104 +58 -162	
.05 -1.65 +.56 -149	+51 -200	-1.41 +.45 -128 +41 -169	
.10 -1.60 +.30 -145	+27 -172	-1.42 +.22 -128 +20 -148	
.20 -1.84 +.14 -166	+13 -179	-1.71 +.08 -155 +7 -162	
.30 -1.82 +.08 -164	+7 -171	-1.72 +.02 -155 +2 -151	
.40 -1.64 +.13 -148	+12 -160	-1.56 +.10 -141 +9 -150	
.50 -1.41 +.25 -127	+23 -150	-1.36 +.22 -123 +20 -143	
.60 -1.22 +.36 -110	+33 -143	-1.18 +.34 -107 +31 -138	
.70 -1.98 +.42 -89	+38 -127	-.92 +.42 -87 +38 -125	
.80 -.36 +.48 -33	+43 -76	-.37 +.48 -33 +43 -76	
.835 +.25 +.22 +23	+20 +3 +.24 +.20 +22 +1.8 +4		
# REF: TABLE II P-5			

By: Kipfle  
B60 1512 1/3/43

CONSOLIDATED VULTEE AIRCRAFT CORPORATION  
PORT WILMINGTON, MASS.

PW 613 ICS PAGE 11

TABLE VI

CHORDWISE AIRLOAD DISTRIBUTION  
WING BULKHEAD # 22

PAGE 9

X DESIGN GROSS WRIGHT-FLAPS  
C DOWN-LANDING GEAR EXTENDED

\* $C_L = 1.723$  \*LIMIT 8 = 90.4  
(APG)<sub>U</sub> (APG)<sub>L</sub> APV DPL Pnet

F25-30-242  
XB-36  
5/48

X	GROSS	WRIGHT-FLAPS	DOWN-LANDING GEAR EXTENDED			
0	+ .98	+ 1.10	+ 85.6	+ 99.5	- 10.9	
.005	- 1.22	+ 1.10	- 10.3	+ 99.5	- 209.8	
.01	- 1.30	+ 1.00	- 111.5	+ 90.4	- 207.9	
.025	1.47	+ 0.75	- 132.9	- 67.3	- 200.7	
.05	- 1.66	+ 0.56	- 150.1	+ 50.6	- 200.7	
.10	- 1.61	+ 0.31	- 145.6	+ 28.0	- 173.6	
.20	- 1.85	+ 0.14	- 167.3	+ 12.7	- 180.0	
.30	- 1.83	+ 0.08	- 165.5	+ 7.2	- 172.7	
.40	- 1.64	+ 0.14	- 148.3	+ 12.7	- 161.0	
.50	- 1.41	+ 0.25	127.5	- 22.6	- 159.1	
.60	- 1.22	+ 0.35	- 110.3	+ 31.6	- 141.9	
.70	- 0.98	+ 0.42	- 98.6	+ 38.0	- 126.6	
.80	- 0.36	+ 0.48	- 32.5	+ 43.4	- 75.9	
.835	+ 0.25	+ 0.22	+ 22.6	+ 19.9	+ 2.7	
.90						
.100						

\* Ref: TABLE II P-5

CALCULATED BY Gandy  
CHECKED BY Confield

**CONSOLIDATED VULTEE AIRCRAFT CORPORATION**  
FORT WORTH DIVISION  
FW 633 7-46 ENGINEERING RULED TABULATION PAD—VELLUM

**FW 833 7-46 ENGINEERING RULED TABULATION PAD—VELLUM**

**WING BULKHEAD #23**  
**TABLE III CHORDWISE AIRLOAD PRESSURE DISTRIBUTION**

PAGE 10  
F25-36-242  
XAS-36  
11/21/48

% CHORD (%)	MFN - LAA @ 5000 FEET						MFN - LAA @ 5000 FEET					
	*C <sub>L</sub> = .5895	*g = 213.1 (LMIIT)	*M <sub>0</sub> = .916		*C <sub>L</sub> = -.2925	*g = 213.1 (LMIIT)	*M <sub>0</sub> = .916					
	OP <sub>q</sub>	DP <sub>q</sub>	OP <sub>P</sub>	DP <sub>P</sub>	OP <sub>q</sub>	DP <sub>q</sub>	OP <sub>P</sub>	DP <sub>P</sub>	OP <sub>q</sub>	DP <sub>q</sub>	OP <sub>P</sub>	DP <sub>P</sub>
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)		
			8X(1)	9X(2)		.			8X(7)	9X(8)		
0	+1.03	+1.03	+220	+220	0	+1.03	+1.03	+220	+220	0		
.005	-.14	+.64	-30	+136	-166	+.74	-.52	+200	-111	+.311		
.010	-.28	+.52	-60	+111	-176	+.83	-.83	+177	-177	+.354		
.025	-.56	+.28	-119	+60	-179	+.61	-1.18	+130	-251	+.381		
.050	-.76	+.07	-162	+15	-177	+.37	-1.21	+79	-258	+.337		
.100	-1.00	-.15	-213	-32	-181	+.01	-1.12	+2	-238	+.240		
.200	-1.20	-.36	-256	-77	-179	-.41	-1.05	-87	-224	+.137		
.300	-1.23	-.95	-262	-96	-176	-.58	-.93	-124	-198	+.74		
.400	-1.01	-.31	-268	-17	147	-.60	-.14	-142	-.12	-.22		
.500	-.84	-.24	-179	-51	-128	-.51	-.48	-109	-102	-7		
.600	-.59	-.09	-126	-17	-109	-.37	-.26	-79	-55	-24		
.700	-.36	+.02	-77	+4	-81	-.21	-.10	-45	-21	-24		
.800	-.12	+.14	-26	+30	-56	-.05	+.06	..11	+.13	-24		
.900	+.08	+.28	+17	+60	-43	+.10	+.24	+21	+51	-30		
1.000	+.24	+.24	+51	+51	0	+.24	+.24	+51	+51	0		

\* REF: TABLE II p.5

PREPARED BY: RUSSELL 11/3/92  
CHECKED BY: Confield 11/21/92

ANALYSIS... WING  
PREPARED BY Mifford  
CHECKED BY  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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WING BULKHEAD #0.0  
(36W100)

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INTRODUCTION -----	12
DETERMINATION OF STIFFENER LOADS -----	13
VERTICAL STIFFENER DESIGN -----	16

ANALYSIS Wing  
PREPARED BY myfford  
CHECKED BY lewis  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
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FORT WORTH, TEXAS

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WING BULKHEAD #0.0  
(36.100)

INTRODUCTION

The structure of Bulkhead #0.0 for the XB-36 is identical to that used for the B-36A. All design loads for both airplanes are determined from wing stresses and bending moments. The distribution of these loads is similar for corresponding XB and B-36 conditions. Since the bulkhead web shears and flange loads are proportional to the wing bending stresses for corresponding conditions, it is expected that web shears and flange loads will increase by the average percentage difference of the XB-36 over the B-36A stresses. Table VIII, page 14 will show 10% to be a conservative estimate of this increase.

All webs, flanges, web splices and web flange attachments have margins appreciably in excess of 10% and it is therefore felt to be unnecessary to reanalyze these items for the XB-36 Airplane.

Some of the vertical stiffeners have low margins and inasmuch as a portion of their loading is a function of crushing loads, a quantity that varies as the square of the wing bending moment, all the stiffeners will be checked for the higher XB-36 loads. The methods and assumptions used will be the same as for bulkhead #0.0 on the B-36A Airplane. (Ref. FZS-36-142).

The following condition imparts critical stiffener loading:

R.G.W. 226,730# (72-1000# Bombs) L.A.A. @ 5000'

Note: This airplane configuration also produces critical stiffener loads for the B-36A Airplane.

ANALYSIS WING, PART III  
PREPARED BY Russell  
CHECKED BY Beefton  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. FLS-36-242  
MODEL XB-36  
DATE 5/48

## VERTICAL STIFFENER ANALYSIS WING BLKD. #0.0

ALL SECTION PROPERTIES, ALLOWABLES,  
AND ASSUMPTIONS ARE THE SAME  
AS FOR THE B-36A ANALYSIS. SEE REPORT  
No. FLS-36-142, PAGE I-71.

### CRUSHING LOADS

$$M'_x = 151,000,000^{\frac{1}{2}} \text{ (REPT. FLS-36-241, P. 63)}$$

$$I_x = 162,647^{\frac{1}{4}}$$

$$h_x = 81.2'' = (I/Q)_x$$

$$L = 41.025''$$

$$w = M^2/EIh = 1/''$$

$$\text{NET CRUSH. LOAD ON BLKD} = wL = \frac{(M'_x)^2 L}{EI_x (I/Q)_x}$$

$$P_{cr} = \frac{(151 \times 10^6)^2 \cdot 41.025}{(10.3 \times 10^6) 162,647 \times 81.2} = 6875^{\frac{1}{2}}$$

$$\text{AVERAGE } P_{cr} = \frac{6875}{124} = 55.5^{\frac{1}{2}}/''$$

$$\text{AV SPAR DEPTH} = 74.75''$$

$$w_{F.S} = \frac{65.46}{74.75} (55.5) = 48.5^{\frac{1}{2}}/''$$

$$w_{R.S} = \frac{84.03}{74.75} (55.5) = 62.4^{\frac{1}{2}}/''$$

62.4<sup>1/2</sup>/''

48.5<sup>1/2</sup>/''



E.R.S.

**CONSOLIDATED VULTEE AIRCRAFT CORPORATION**  
FORT WORTH DIVISION FORT WORTH, TEXAS

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FW 533 125 PADS 11-43

ELEMENT No.	STR. STRESS	STR. STRESS	RATIO	V	V	* REPT NO. FZS-36-2 MODEL XB-36 DATE 10-23-4
	3.76A	2.10	STRSS	B-36A	XB-36	
1	2	3	4	5	6	BY: Ed Russell CHR: B. Kington
FEB-36-43	FEB-36-43	(3)	(2)	FEB-36-43	(4)	PAGE 1-18 PAGE 37

**LOWER SURFACE**

1	34.820	31.340	1.072	19.023	20.400
2	34.804	31.310	1.076	21.686	23.400
3	34.474	31.682	1.080	22.081	23.800
4	33.740	36.500	1.082	21.885	23.700
5	32.583	35.230	1.082	21.047	22.800
6	31.178	33.810	1.087	20.595	22.200
7	29.103	31.170	1.092	19.309	21.100
8	26.218	29.030	1.105	17.737	19.500
9	23.560	26.050	1.105	16.928	18.700
10	20.932	22.230	1.110	9.663	10.700

**UPPER SURFACE**

11	-37.50	-37.440	1.072	-1901	-2040
12	-36.50	-39.400	1.075	+2014	+2160
13	-38.373	-40.960	1.078	1825	1970
14	-38.900	-41.890	1.078	1707	1840
15	-38.148	-42.950	1.106	1024	1140
16	-40.750	-43.850	1.084	1799	1950
17	-40.752	-44.310	1.085	500	540
18	-41.178	-44.910	1.082	244	264
19	-41.186	-44.730	1.086	0	0
20	-41.007	-44.630	1.090	-260	-284
21	-40.927	-44.330	1.090	-573	-625
22	-40.443	-43.870	1.092	-747	-815
23	-39.525	-42.250	1.095	-1026	-1123
24	-38.177	-42.470	1.095	-1372	-1502
25	-37.180	-41.150	1.096	-1004	-1100
26	-35.520	-39.100	1.100	-1858	-2040

TABLE 2000  
C. S - VERTIGE STIFFNESSES  
C. N - STEINGER STRESSES  
C. G - C.G. =  
B.R.D \* C.O. =  
LOADS DUE TO 50%  
L.B.P. - 4.5. @ 50%

\* POSITIVE LOADS ACT UP

ANALYSIS WING - PART III  
PREPARED BY RUSSELL  
CHECKED BY SCHAFER  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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## VERTICAL STIFFENER ANALYSIS (CONT'D) WING BLKD. #0.0

### CALCULATION OF STIFFENER END LOADS (EXAMPLE)

STIFFENER -11 (FWD):

$$\text{CRUSHING} = 49.28 \text{#/in}$$

$$\#19 = 0\#$$

$$\#20 = 284\# (\text{DOWN})$$

$$\#5 = 22,800\# (\text{UP})$$

(REF: P-14)

40.28#/in. (AVERAGE)



CRUSHING:

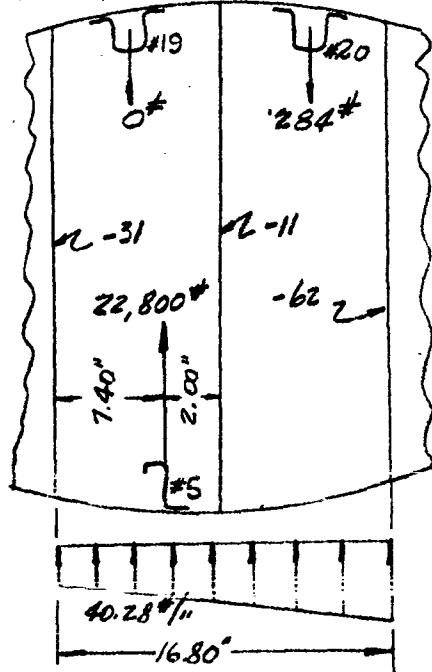
$$P_u = \frac{49.28(16.80)}{2} = 415\# (\text{DOWN})$$

$$P_e = 415\# (\text{UP})$$

ELEMENT:

$$P_u = \frac{0+284}{2} = 142\# (\text{DOWN})$$

$$P_e = \frac{7.40}{9.40} (22,800) = 17,960\# (\text{UP})$$



TOTAL STIFF. LOADS:

$$P_{u(\text{TOTAL})} = 415 + 142 = 557\# (\text{DOWN})$$

$$P_{e(\text{TOTAL})} = 415 + 17960 = 18,375\# (\text{UP})$$

THE STIFFENER END LOADS AS LISTED IN TABLE COL. 8 AND 9 WERE COMPUTED IN A SIMILAR MANNER.

CONSOLIDATED VULTEE AIRCRAFT CORPORATION TABLE IX  
FORT WORTH DIVISION PLATE WORK, U.S.A.BLRD #0.0 - WING C.S. - VERT. STIFFENERS DESIGN  
L.A.A. - H.S. @ 5000' - R.G.W = 226730F

PAGE 16

STIFF DASH NO.	A <sub>s</sub> (GRIFF AREA)	A <sub>p</sub> (WEB AREA)	A <sub>t</sub> (TOTAL AREA)	L	P	4/P	I <sub>sp</sub>	P <sub>o</sub>	P <sub>r</sub>	PAVE.	f <sub>c</sub> AVE	f <sub>c</sub>	f <sub>c</sub> MAX	F <sub>c</sub>	M. S.		REPORT No.: FZB-54-242 MODEL: X-2-36 DATE: 10-23-47
															COL.	CRIP.	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	BY: <u>W.R. Russell</u>
			2010			④/⑤			③+④/⑥	②/③	④/⑤	③+④/⑥	②/③	④/⑤	③+④/⑥	②/③	CHK: <u>W.C. Gandy</u>
-18	.2298	.0566	.5162	65.70	1.204	54.5	.7486	+1610	-9655	4843	9380	45	9425	18,760	34600	+2.35 +2.67	
-17	.2298	.0566	.5162	69.20	1.204	57.4	.7486	+1542	-9843	4922	9530	990	10,520	19,060	31,100	+2.29 +1.96	
-16	.2298	.0566	.5162	72.51	1.204	60.0	.7456	+1072	-13268	6634	12850	3550	16,400	25,700	2859	+1.45 +.74	
-15	.2298	.0566	.5162	75.20	1.204	62.4	.7456	+1115	-3240	6620	12800	6870	19,670	25,600	29300	+1.45 +.34	
-14	.2872	.1430	.7174	79.65	1.149	67.6	.9458	+851	-15344	7672	10,700	7,045	12,775	71,400	22,900	+1.94 +.76	
-13	.2872	.1430	.7174	79.55	1.149	69.3	.9458	-18	-14120	7069	9,810	3450	13,320	19,700	21,150	+2.19 +.61	
-12	.2872	.1430	.7174	80.95	1.149	70.5	.9458	-310	-13182	7046	9830	4630	14,460	19,200	20,900	+2.27 +.45	
-11	.2872	.1430	.7174	81.91	1.149	71.4	.9458	-557	-18315	9466	15,500	6280	19,480	25,600	20,000	+1.94 +.03	
-6	.2872	.1430	.7174	82.15	1.149	71.7	.9458	-860	-13305	7882	7810	7070	16,960	16,200	19,800	+2.55 +.11	
-14	.2872	.2268	.8012	72.41	1.108	74.4	.9828	-1320	-15390	8405	10,500	4200	14,800	19,500	18,400	+2.22 +.24	
-11	.2872	.2268	.8012	82.11	1.108	74.3	.9838	-1392	-19471	10,481	13,350	5070	18,420	25,200	18,500	+1.51 +.003	
-10	.2872	.2268	.8012	81.79	1.108	73.5	.9838	-1692	-5330	3512	4380	4140	3620	6,650	18,800	+8.42 +1.18	
-9	.2872	.2268	.8012	80.46	1.108	72.6	.9838	-1776	-18925	10,351	12,900	5450	18,350	23,600	19,300	+1.66 +.05	

POINT 4: L.D. &amp; MAX. TENSILE ON STIFFENERS

\* TENSILE LOADS ARE CONSIDERED IN THE NEUTRAL ZONE

SEE TABLE I-XL REPORT FZB-54-242, PART I-III FOR STIFFENER PROPERTIES

ANALYSIS Wing  
PREPARED BY Lowrey  
CHECKED BY Refford  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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WING BULKHEAD STA. 10  
(36W110)

DISCUSSION

The bulkhead structure at wing Sta. 10 is the same on the B-36A and XB-36. This bulkhead is designed by the stiffness required to stabilize the plate stringers. (Ref. FZS-36-142, P. I-125).

The critical conditions are, those giving maximum stringer loads "P" Cond. I; Alternate Gross Weight, 265,000#, (72-1000# Bombs) H.A.A. @ 5000' and, Cond. II; Design Gross Weight, 265,192#, L.A.A., H.S. @ 5000'.

The values for "P" (stringer load in lbs), crushing loads, and airloads will be ratioed from the loads on the B-36A.  $F_{cr}$  (Critical stringer load for two bay length) remains unchanged for the XB-36 since it is a function of stringer stiffness and column length. "P" is ratioed in proportion to the respective bending moments. The crushing loads are directly proportional as the square of the bending stress, therefore, will be ratioed in proportion to the square of the bending moment ratios. The air load will be ratioed in proportion to the total airload.

ANALYSIS WING  
PREPARED BY LONREY  
CHECKED BY J. H. JONES  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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DATE 4/26/48

WING BULKHEAD STA. 10.

THE CRITICAL "P" FOR THE B-36A WILL BE RATIOED, IN PROPORTION TO THEIR RESPECTIVE BENDING MOMENTS, TO OBTAIN THE "P" VALUES FOR THE XB-36. (P = STRINGER LOAD, LBS.)

B-36A BEND. MOM. (REF. F25-36-192, PG. I-133)

CONDITIONS:

- I. D.G.W. - H.A.A. @ 5000 FT.
- II. D.G.W., L.A.A. @ 5000 FT.

STA. 10

COND. I B.M. = 78,260,000 \*\*  
COND. II B.M. = 99,205,000 \*\*

STA. 11

COND. I B.M. = 75,740,000 \*\*  
COND. II B.M. = 96,547,000 \*\*

XB-36 BEND. MOM. (REF. F25-36-240, PGS. 234 & 235)

CONDITIONS:

- I. A.G.W. 265,600 \* (72-1000 \* comes) H.A.A @ 5000 FT.
- II. D.G.W. L.A.A. @ 5000 FT.

STA. 10

COND. I B.M. = 95,400,000 \*\*  
COND. II B.M. = 99,000,000 \*\*

STA. 11

COND. I B.M. = 91,200,600 \*\*  
COND. II B.M. = 95,400,000 \*\*

ANALYSIS WING  
PREPARED BY LOWREY  
CHECKED BY JOHNSON  
REVISED BY

Consolidated Vultee Aircraft Corporation  
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FORT WORTH, TEXAS

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### WING BULKHEAD STA. 10

#### BENDING MOMENT RATIOS

##### STA. 10

$$\text{COND. I, } R_1 = \frac{95,400,000}{98,260,000} = .97$$

$$\text{COND. II, } R_2 = \frac{99,500,000}{99,205,000} = 1.003$$

##### STA. 11

$$\text{COND. I, } R_1 = \frac{91,200,000}{95,740,000} = .952$$

$$\text{COND. II, } R_2 = \frac{95,400,000}{96,547,000} = .989$$

$$\text{AVERAGE RATIO FOR COND. I} = \frac{.97 + .952}{2} = \underline{\underline{.961}}$$

$$\text{AVERAGE RATIO FOR COND. II} = \frac{1.003 + .989}{2} = \underline{\underline{.996}}$$

$$\begin{aligned} \text{CRITICAL P (B-36A)} &= 151,200^{\#}, \text{ COND. I} \quad \left\{ \text{REF F2S-36-142} \right. \\ &= 113,000^{\#}, \text{ COND. II} \quad \left. \left\{ \text{PG. I-133} \right. \right. \end{aligned}$$

$P(XB-36)$ :

$$\text{COND. I} = 151,200 \times .961 = \underline{\underline{146,200}}^{\#}$$

$$\text{COND. II} = 113,000 \times .996 = \underline{\underline{112,500}}^{\#}$$

$P_{CR}(XB-36)$ :

$$\text{COND. I} = 125,100^{\#} \quad \left\{ \text{REF F2S-36-142} \right.$$

$$\text{COND. II} = 97,200^{\#} \quad \left. \left\{ \text{PG. I-133} \right. \right.$$

$P-K_{CR}(XB-36)$ :

$$\text{COND. I} = 146,200 - 125,100 = 21,100^{\#}$$

$$\text{COND. II} = 112,500 - 97,200 = 15,300^{\#}$$

ANALYSIS WING  
PREPARED BY LOURAY  
CHECKED BY JONES  
REVISED BY \_\_\_\_\_

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FORT WORTH, TEXAS

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### WING BULKHEAD STA. 1Q

THE AIRLOAD TO THE BULKHEAD FOR THE B-36A WILL BE RATIOED FOR THE XB-36 IN PROPORTION TO THEIR RESPECTIVE TOTAL AIRLOAD VALUES. CONDITIONS ARE THE SAME AS SHOWN ON PG.

#### B-36A

$$\begin{aligned} \text{COND. I } , \frac{Z}{W} &= +2.691 \quad \left\{ \begin{array}{l} \text{REF F2S-36-136} \\ \text{PG. 30} \end{array} \right\} \text{GW} = 278,600^* \\ \text{COND. II } , \frac{Z}{W} &= +2.745 \quad \left\{ \begin{array}{l} \text{REF F2S-36-136} \\ \text{PG. 30} \end{array} \right\} \quad " \end{aligned}$$

$$\text{COND. I } , Z = 2.691 \times 278,600 = 747,000^*$$

$$\text{COND. II } , Z = 2.745 \times 278,600 = 763,000^*$$

#### XB-36

$$\begin{aligned} \text{COND. I } , \frac{Z}{W} &= +2.697 \quad \left\{ \begin{array}{l} \text{REF F2S-36-126} \\ \text{PG. 45} \end{array} \right\} \text{GW} = 265,000^* \\ \text{COND. II } , \frac{Z}{W} &= +2.887 \quad \left\{ \begin{array}{l} \text{REF F2S-36-126} \\ \text{PG. 45} \end{array} \right\} \text{GW} = 265,192^* \end{aligned}$$

$$\text{COND. I } , Z = 2.697 \times 265,000 = 715,000^*$$

$$\text{COND. II } , Z = 2.887 \times 265,192 = 765,000^*$$

#### AIRLOAD RATIOS

$$\text{COND. I } , R_1 = \frac{715,000}{747,000} = .957$$

$$\text{COND. II } , R_2 = \frac{765,000}{715,000} = 1.002$$

$$\text{AIRLOAD (B-36A)} , \quad \begin{aligned} \text{COND. I} &= -56.1 \% \text{N.} \\ \text{COND. II} &= -72.2 \% \text{N.} \end{aligned} \quad \left\{ \begin{array}{l} \text{REF F2S-36-142} \\ \text{PG. 1-136} \end{array} \right\}$$

$$\text{AIRLOAD (XB-36)} , \quad \begin{aligned} \text{COND. I} &= -56.1 \times .957 = -53.6 \% \text{N.} \\ \text{COND. II} &= -72.2 \times 1.002 = -72.4 \% \text{N.} \end{aligned}$$

ANALYSIS WING  
PREPARED BY Conrey  
CHECKED BY Fatima  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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WING BULKHEAD STA 10

THE CRUSHING LOADS WILL BE RATIOED  
ACCORDING TO THE SQUARES OF THE BEND  
MOM. RATIOS. CONDITIONS ARE SAME AS ON  
PG.

$$\text{RATIO (COND. I)} = (.961)^2 = .924$$

$$\text{RATIO (COND II)} = (.996)^2 = .992$$

CRUSHING LOADS (B-36A):

$$\begin{aligned} \text{COND. I} &= 50.3 \frac{\text{lb}}{\text{in.}} & \left. \begin{array}{l} \text{(REF F25-36-142)} \\ \text{16 I-136} \end{array} \right\} \\ \text{COND. II} &= 49.2 \frac{\text{lb}}{\text{in.}} \end{aligned}$$

CRUSHING LOADS (XB-36):

$$\text{COND I} = .924 \times 50.3 = \underline{46.5} \frac{\text{lb}}{\text{in.}}$$

$$\text{COND II} = .992 \times 49.2 = \underline{48.8} \frac{\text{lb}}{\text{in.}}$$

SUMMARY

COND I:

$$\text{CRITICAL } P - P_{CR} = 21,100^*$$

$$W_0 = 53.6 - 46.5 = 7.1 \frac{\text{lb}}{\text{in.}}$$

COND II:

$$\text{CRITICAL } P - P_{CR} = 15,300^*$$

$$W_0 = 72.4 - 48.8 = 23.6 \frac{\text{lb}}{\text{in.}}$$

ANALYSIS WING  
PREPARED BY COWREY  
CHECKED BY Johmson  
REVISED BY \_\_\_\_\_

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FORT WORTH, TEXAS

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## WING BULKHEAD STA 10

### CONCLUSION :

#### COMPARISON OF LOADS ON B-36A AND XB-36

ITEM	B-36A (FZS-36-142) pg I-36	XB-36	COND.
P-Pcr	26,100"	21,100"	I
P-Pcr.	15,900"	15,300"	II
W <sub>o</sub> *	5.8 "in	7.1 "in	I
W <sub>o</sub>	23.0 "in	23.6 "in	II

\* W<sub>o</sub> = NET LOAD #/IN.

THE COMPARISON OF THE DEFLECTION OF THE THEORETICAL BEAM AND THE ACTUAL CROSS-BEAM SYSTEM FOR THE B-36A, IS MADE FOR CONDITION II, THE CONDITION HAVING THE LARGER W<sub>o</sub> (REF. FZS-36-142, PG. I-150). A DEFLECTION OF THE CROSS BEAM SYSTEM UNDER A 23"IN LOADING AS COMPARED TO THE DEFLECTION OF THE FICTITIOUS BEAM WITH THE REQUIRED I (33.4"IN<sup>4</sup>) FOR STABILITY UNDER A CHORDWISE LOADING OF 28#/IN INDICATES A LARGE MARGIN OF SAFETY.

THE SLIGHT INCREASE IN LOADING FOR THE XB-36 SYSTEM - W<sub>o</sub> = 23.6 "#/IN VERSUS 23 "#/IN (B-36A) WILL BE MORE THAN OFFSET BY THE EXCESS STIFFNESS SUPPLIED BY VIRTUE OF THE DECREASE IN (P-Pcr).

ANALYSIS WING  
PREPARED BY Myfford  
CHECKED BY \_\_\_\_\_  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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## WING BULKHEAD #3

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TITLE	PAGE
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DETERMINATION OF AIR LOADS	
CHORDWISE AIR LOAD DISTRIBUTION CURVE	26
COMPUTATION OF BULKHEAD AIR LOADS	
DGW(265192") 1LAA @ 5000'	27
AGW (72-1000" BOMBS) HAA @ 5000'	28
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DETAIL ANALYSIS	
MARGINS OF SAFETY OF TRUSS TUBES IN COMPRESSION	47

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PREPARED BY Mefford  
CHECKED BY  
REVISED BY

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FORT WORTH DIVISION  
FORT WORTH, TEXAS

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ANALYSIS OF TUBES IN TENSION, MEMBER "OP"- 49

ANALYSIS OF CHORD MEMBERS ----- 50

ANALYSIS OF UPPER INTERCOSTAL ----- 51

ANALYSIS Wing  
PREPARED BY Mefford  
CHECKED BY J. Oliver  
REVISED BY

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FORT WORTH DIVISION  
FORT WORTH, TEXAS

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DATE 5/48

BULKHEAD #3 (36W4103)

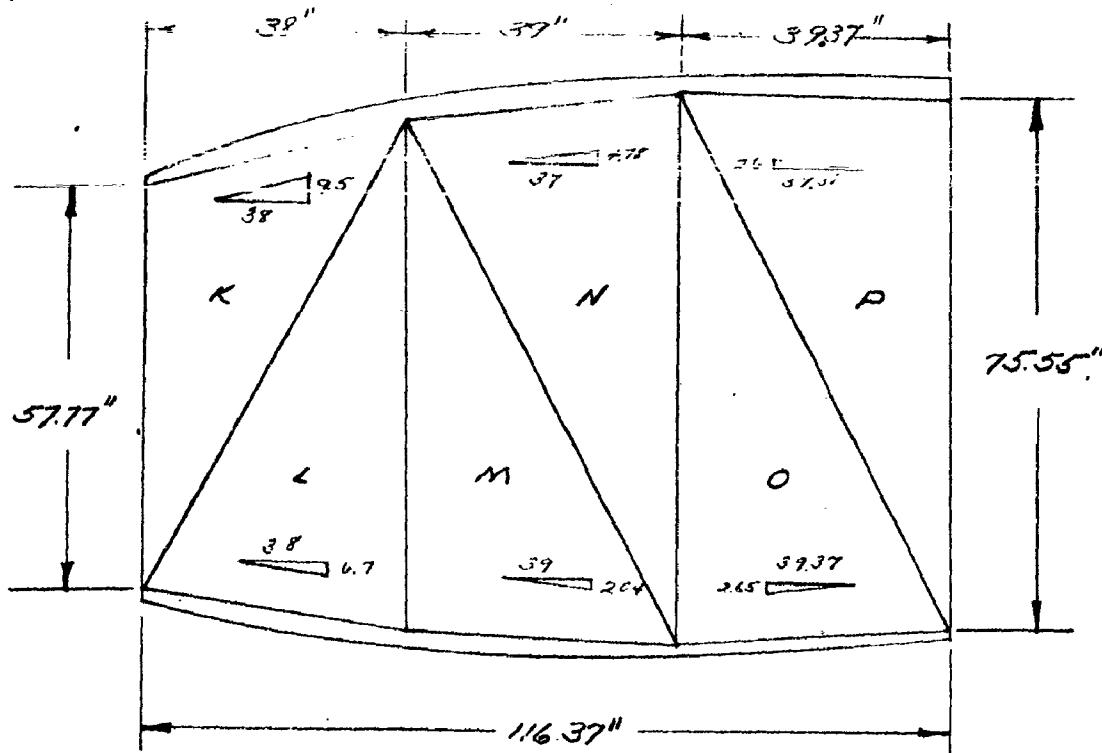
INTRODUCTION

Wing bulkhead #3 of the XB-36 is structurally similar to bulkhead #3 of the B-36A; therefore, the description of the bulkhead and the method of analysis given on page I-154 of FZS-36-142 applies to the XB-36 bulkhead.

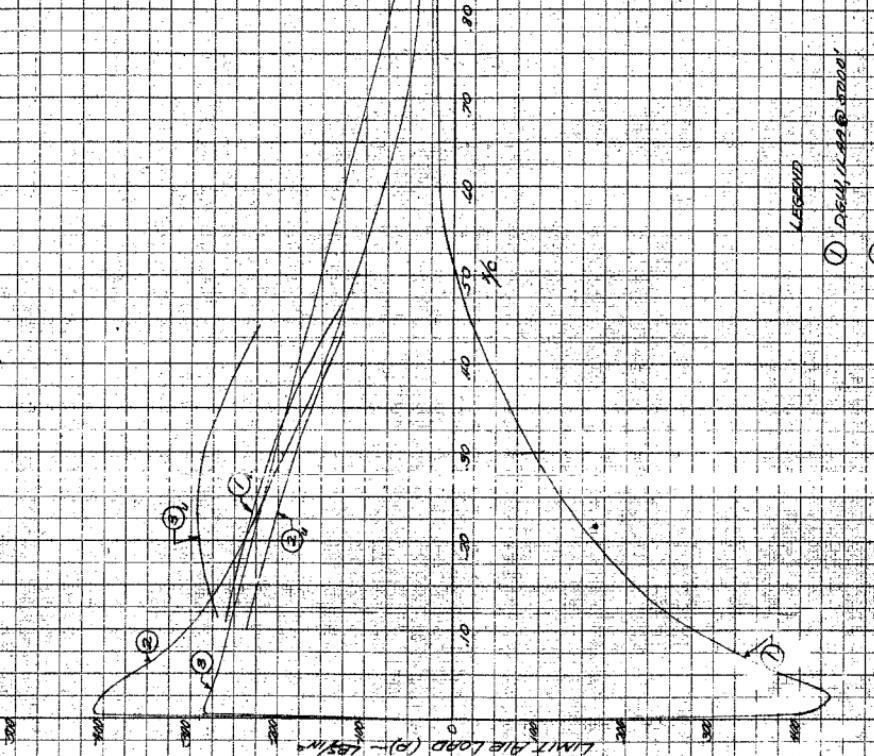
The critical loading conditions for bulkhead #3 of the XB-36 Airplane are:

- I. D.G.W. (265,192#) ILAA @ 5000'
- II. A.G.W. (72-1000# Bombs) HAA @ 5000'
- III. A.G.W. (72-1000# Bombs) LAA A 5000'

SKETCH OF BULKHEAD #3



COUNTERWISE AIR LOAD DISTRIBUTION  
GONDOLA 3  
(centerline)



CALCULATED BY  
DRAWN BY  
CHECKED BY  
APPROVED BY  
APPROVED AT

FIGURE 1  
CONSOLIDATED VULTEE AIRCRAFT CORPORATION  
EAST WORTH DIVISION, EAST WORTH TEAM

DOA NO. 50  
FEB 1947

MATERIAL

X-5-50

KENNETT FERRIBO CO. INC.  
2000 26

CONSOLIDATED VULTEE AIRCRAFT CORPORATION  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

PW 613 125 PADS 1145

COMPUTATION OF  $N_x$ ,  $N_y$ ,  $M_x$ ,  $M_y$ , &  $M_z$  FOR AER 221023  
X-52 SLEW 3 DGW 2651925 11-11 @ 5000'

REPORT NO. 102  
DATE 5-48

X-52

1	2	3	4	5	6
DISTANCE					
FROM C.G.					
2 CHORD	P %	ANGLE	INCREMENT TO C.G.	TO C.G.	LIMIT
	1%		FROM 15% OF 2 CHORD	15% OF 2 CHORD	

LEADING EDGE AER 10102

0	0	3.75	3.75	.114	.428
1	414	122	4.22	.005	.444
2	430	130	4.30	.015	.107
3	430	120	4.20	.155	.357
4	410	16.47		44.37	

$P_{M_1}$  SM (3)  $M_{M_1}$  (4) + (5)

5	10.1	1	410	4	.24
6	351	4	1428	5	.120
7	515	5	352	2	.1243
8	522	6	1116	1	.114
9	512	1	347	0	.1

10	522	7	1116	1	.114
11	512	1	347	0	.1

$$N_x = \frac{1562^2}{144} [0.5875 \times 2848] = 4780^4$$

$$N_y = \frac{144}{144} L = 3 J = 4780^4$$

$$N_z = \frac{1562^2}{144} [0.5875 \times 3111] = 8260^4$$

$$M_x = \frac{1562^2}{144} [0.5875 \times 2296] = 193,000^4$$

$$M_y = \frac{1562^2}{144} [0.5875 \times 1776] = 138,000^4$$

$$X = \frac{175,300}{4780^4} = 0.01^4$$

$$X = \frac{138,000}{4780^4} = 0.01^4$$

$$M_z = \frac{1562^2}{144} [0.5875 \times 3111] = 136,000^4$$

$$* DEFINITION OF TERMS:$$

N - LEADING EDGE ANGLE SIN 10°

M - LEADING EDGE MOMENT

M<sub>x</sub> - LEADING EDGE SPANWISE MOMENT

M<sub>y</sub> - LEADING EDGE SPANWISE MOMENT

M<sub>z</sub> - LEADING EDGE SPANWISE MOMENT

N<sub>x</sub> - LEADING EDGE SPANWISE MOMENT

N<sub>y</sub> - LEADING EDGE SPANWISE MOMENT

N<sub>z</sub> - LEADING EDGE SPANWISE MOMENT

M<sub>x</sub> - LEADING EDGE SPANWISE MOMENT

M<sub>y</sub> - LEADING EDGE SPANWISE MOMENT

M<sub>z</sub> - LEADING EDGE SPANWISE MOMENT

**CONSOLIDATED VULTEE AIRCRAFT CORPORATION**  
 FORT WORTH DIVISION  
 FORT WORTH, TEXAS

EN 621-121 FARM 11-43

PORT WORTH DIVISION PORT WORTH, TEXAS

PAGE 2  
REPORT NO. 10-5  
DATE 5-41

**CONSOLIDATED VULTEE AIRCRAFT CORP.**  
FORT WORTH DIVISION FORT WORTH, TEXAS

**PW 639 125 PADS 11-43**

SECTION COMPUTATION OF  $N_1$ ,  $N_2$ ,  $N_{12}$ ,  $M_1$ ,  $M_2$ ,  $M_{12}$  FOR THE LUMIUS  
BULKHEADS 3 AGWU (72-1000" BOMBS) LAA @ 5000'

REPORT NO THREE  
PART II

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
DISTANCE FROM TO CROWN CHARGE	P%	AIRLOAD P	INCREMENT AUGMT M	DISTANCE FROM C.R. TO CROWN CHARGE	INCREMENT AUGMT M	0.961	5 M.	0.080	MOMENT MULTIPLIER	0.010	DISTANCE FROM C.R. TO CROWN CHARGE	P%	5 M.	(P)(M)	INCREMENT M	100		
LIMIT				FROM 120° TO 90° LINE						LIMIT								
FIG 1		@ 201				FIG 1					FIG 1							
LEADING EDGE AIR LOADS						COMPOSITE INTERSPARE AIR LOADS					UPPER SURFACE INTERSPARE AIR LOADS							
0	0					43,000 - 170	1	-120	8	-1360	43,000 - 230	1	-230	8	-1840			
1	-2.84	-200	-2.00	.114	.228	39,125 - 180	4	-720	7	-5040	39,125 - 248	4	-992	7	-6244			
2	-8.80	-282	-282	.105	.386	35,250 - 190	2	-380	6	-2280	35,250 - 266	2	-532	6	-31922			
3	-276	-276	-6.78	.085	.264	31,375 - 200	4	-800	5	-4000	31,375 - 281	4	-1124	5	-5620			
4	-272	-274	-2.74	.085	.233	27,500 - 210	2	-420	4	-1680	27,500 - 290	2	-580	4	-2330			
5	-10.34	-10.34	-10.34			23,625 - 222	4	-881	3	-2664	23,625 - 295	4	-1180	3	-5540			
6	-2.84	-2.84	-2.84			19,750 - 231	2	-462	2	-924	19,750 - 291	2	-582	2	-1164			
7	-2.84	-2.84	-2.84															
8	-2.84	-2.84	-2.84															
9	-2.84	-2.84	-2.84															
10	-2.84	-2.84	-2.84															
11	-2.84	-2.84	-2.84															
12	-2.84	-2.84	-2.84															
13	-2.84	-2.84	-2.84															
14	-2.84	-2.84	-2.84															
15	-2.84	-2.84	-2.84															
16	-2.84	-2.84	-2.84															
17	-2.84	-2.84	-2.84															
18	-2.84	-2.84	-2.84															
19	-2.84	-2.84	-2.84															
20	-2.84	-2.84	-2.84															
21	-2.84	-2.84	-2.84															
22	-2.84	-2.84	-2.84															
23	-2.84	-2.84	-2.84															
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26	-2.84	-2.84	-2.84															
27	-2.84	-2.84	-2.84															
28	-2.84	-2.84	-2.84															
29	-2.84	-2.84	-2.84															
30	-2.84	-2.84	-2.84															
31	-2.84	-2.84	-2.84															
32	-2.84	-2.84	-2.84															
33	-2.84	-2.84	-2.84															
34	-2.84	-2.84	-2.84															
35	-2.84	-2.84	-2.84															
36	-2.84	-2.84	-2.84															
37	-2.84	-2.84	-2.84															
38	-2.84	-2.84	-2.84															
39	-2.84	-2.84	-2.84															
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47	-2.84	-2.84	-2.84															
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53	-2.84	-2.84	-2.84															
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55	-2.84	-2.84	-2.84															
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80	-2.84	-2.84	-2.84															
81	-2.84	-2.84	-2.84															
82	-2.84	-2.84	-2.84															
83	-2.84	-2.84	-2.84															
84	-2.84	-2.84	-2.84															
85	-2.84	-2.84	-2.84															
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87	-2.84	-2.84	-2.84															
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89	-2.84	-2.84	-2.84															
90	-2.84	-2.84	-2.84															
91	-2.84	-2.84	-2.84															
92	-2.84	-2.84	-2.84															
93	-2.84	-2.84	-2.84															
94	-2.84	-2.84	-2.84															
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96	-2.84	-2.84	-2.84															
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99	-2.84	-2.84	-2.84															
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101	-2.84	-2.84	-2.84															
102	-2.84	-2.84	-2.84															
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104	-2.84	-2.84	-2.84															
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107	-2.84	-2.84	-2.84															
108	-2.84	-2.84	-2.84															
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111	-2.84	-2.84	-2.84															
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113	-2.84	-2.84	-2.84															
114	-2.84	-2.84	-2.84															
115	-2.84	-2.84	-2.84															
116	-2.84	-2.84	-2.84															
117	-2.84	-2.84	-2.84															

\* FOR DEFINITION OF TERMS SEE PAGE

BY: Mafford  
CHECKED: P

ANALYSIS WING  
PREPARED BY Mofford  
CHECKED BY Campfield  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

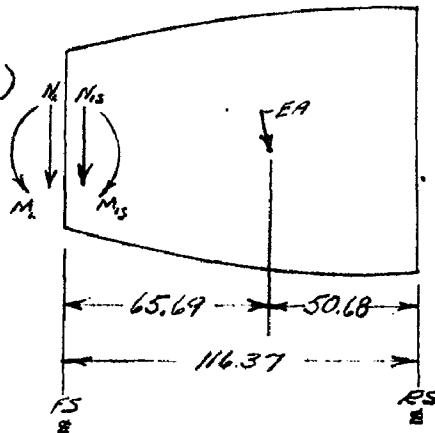
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DATE 11-47

BULKHEAD #3

CONDITION I - DGW (265192#) 1LAA @ 5000'

$$\begin{aligned}N_c &= 5450 \text{ "#} \\M_c &= 134000 \text{ "#} \\N_{cs} &= 4780 \text{ "#} \\M_{cs} &= 195000 \text{ "#} \\N_s &= 8580 \text{ "#} \\M_s &= 458000 \text{ "#}\end{aligned}$$

(REF: TABLE XI)



REACTIONS ON BULKHEAD

TRANSFERRING ALL EXTERNAL FORCES TO FA

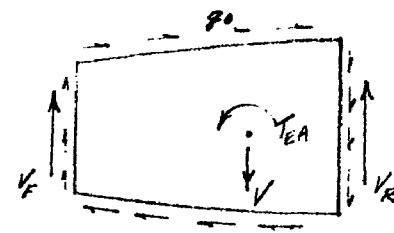
$$V = N_c + N_{cs} = 10230 \text{ "#}$$

$$T_EA = M_c + M_{cs} + 65.69 \times V = 611000 \text{ "#}$$

REACTIONS ON FS & RS DUE TO V

$$V_R = \frac{65.69}{116.37} \times 10230 = 5770 \text{ "#}$$

$$V_F = 10230 - 5770 = 4460 \text{ "#}$$



SHEAR FLOW DUE TO EA

$$q_0 = \frac{611000}{17830} = 342 \text{ "#/in. 2}$$

$$* 2A = 17830 \text{ in.}^2$$

(REF: F2S-36-141 P206)

ANALYSIS WING  
PREPARED BY M. J. Clark  
CHECKED BY C. S. Field  
REVISED BY

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FORT WORTH, TEXAS

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D.G.W. 265,192 # 1L1A @ 5000' (CONT'D)

BULKHEAD #3

CRUSHING LOADS

$$P = \frac{(M')^2 L}{I_y / Q_x E I}$$

$$P = 1405 \text{ #}$$

$$L = 33.25$$

$$M' = -66.70 \times 10^6 \text{ (REF F25-36-240)}$$

$$I_y / Q_x = 75.75''$$

$$I = 134,500 \text{ IN}^4$$

$$E = 10.3 \times 10^6$$

REPLACE "P" WITH EQUIVALENT TRAPEZOID SUCH THAT

$\frac{h_F}{h_R} = \frac{w_F}{w_R}$  WHERE  $h_F$  &  $h_R$  ARE CONTOUR DEPTHS OF  
FRONT & REAR SPAR RESPECTIVELY.

$$w_F = 10.54$$

$$w_R = 13.61$$

AIR LOADS

REPLACING THE AIR LOADS WITH EQUIVALENT  
TRAPEZOIDS.

COMPOSITE INTERSPAR LOAD (NIS)

$$w_{FC} = 77.8 \text{ f}$$

$$w_{RC} = 4.8 \text{ f}$$

LOWER SURFACE LOAD (N.L)

$$w_{FL} = 91.6 \text{ f}$$

$$w_{RL} = 55.9 \text{ f}$$

UPPER SURFACE LOAD

$$w_{FU} = w_{FC} - w_{FL} = 13.8 \text{ f}$$

$$w_{RU} = w_{RC} - w_{RL} = 51.6 \text{ f}$$

ANALYSIS WING  
PREPARED BY M. Ford  
CHECKED BY C. G. Field  
REVISED BY ..

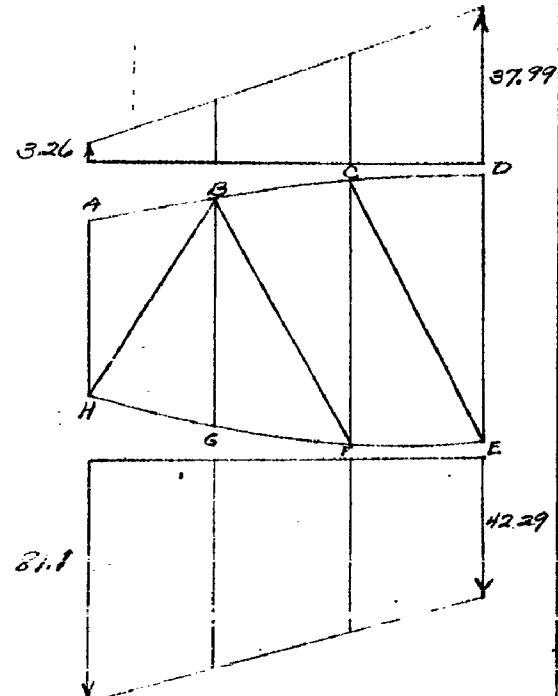
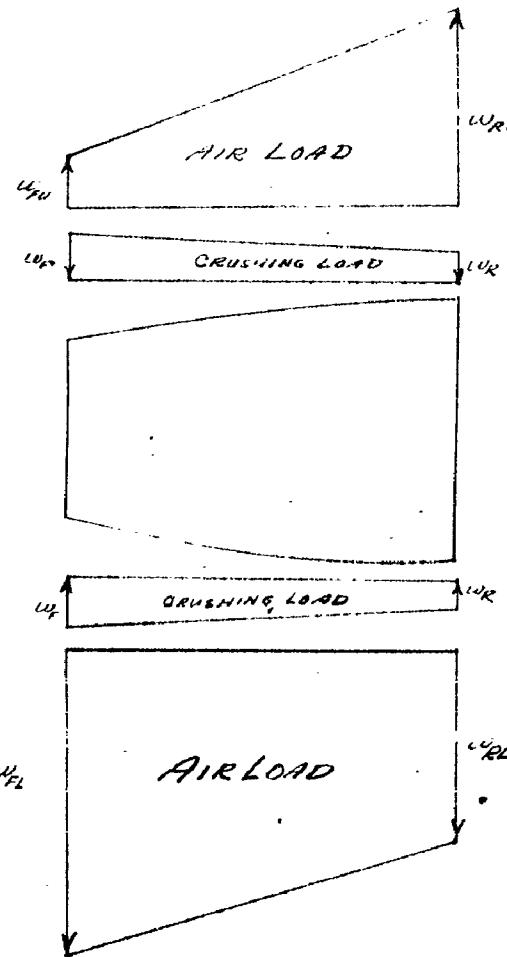
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FORT WORTH, TEXAS

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DGW. 265,192# 1LAA @ 5000' (CONT'D)

BULKHEAD #3

COMBINED AIR & CRUSHING LOADS



BREAKDOWN OF NET AIR AND CRUSHING LOADS  
INTO PANEL POINT LOADS

$$\begin{aligned} P_A &= 133 \# \\ P_B &= 564 \# \\ P_C &= 1028 \# \\ P_D &= 670 \# \end{aligned}$$

$$\begin{aligned} P_E &= 915 \# \\ P_F &= 2165 \# \\ P_G &= 2630 \# \\ P_H &= 1465 \# \end{aligned}$$

ANALYSIS WING  
PREPARED BY Boyle  
CHECKED BY Campbell  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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MODEL XB-36  
DATE 11-47

D.G.W. 265192# 1LAA @ 5000' (CONT'D)

BULKHEAD #3.

CORRECTION LOADS

CORRECTING LOADS ON FRONT & REAR SPAR TO  
ACCOUNT FOR TRANSFER OF THE SHEAR FLOW FROM  
THE CONTOUR TO THE CENTROID OF THE STRAIGHT  
LINE CHORD MEMBER.

$$T_u = 2A_1 g_0 = 20,450^{\prime\prime\prime}$$

$$R_u = \frac{20,450}{116.37} = 175.5^{\prime\prime\prime}$$

$$T_u = 2A_2 g_0 = 9,050^{\prime\prime\prime}$$

$$R_u = \frac{9,050}{116.37} = 77.7^{\prime\prime\prime}$$

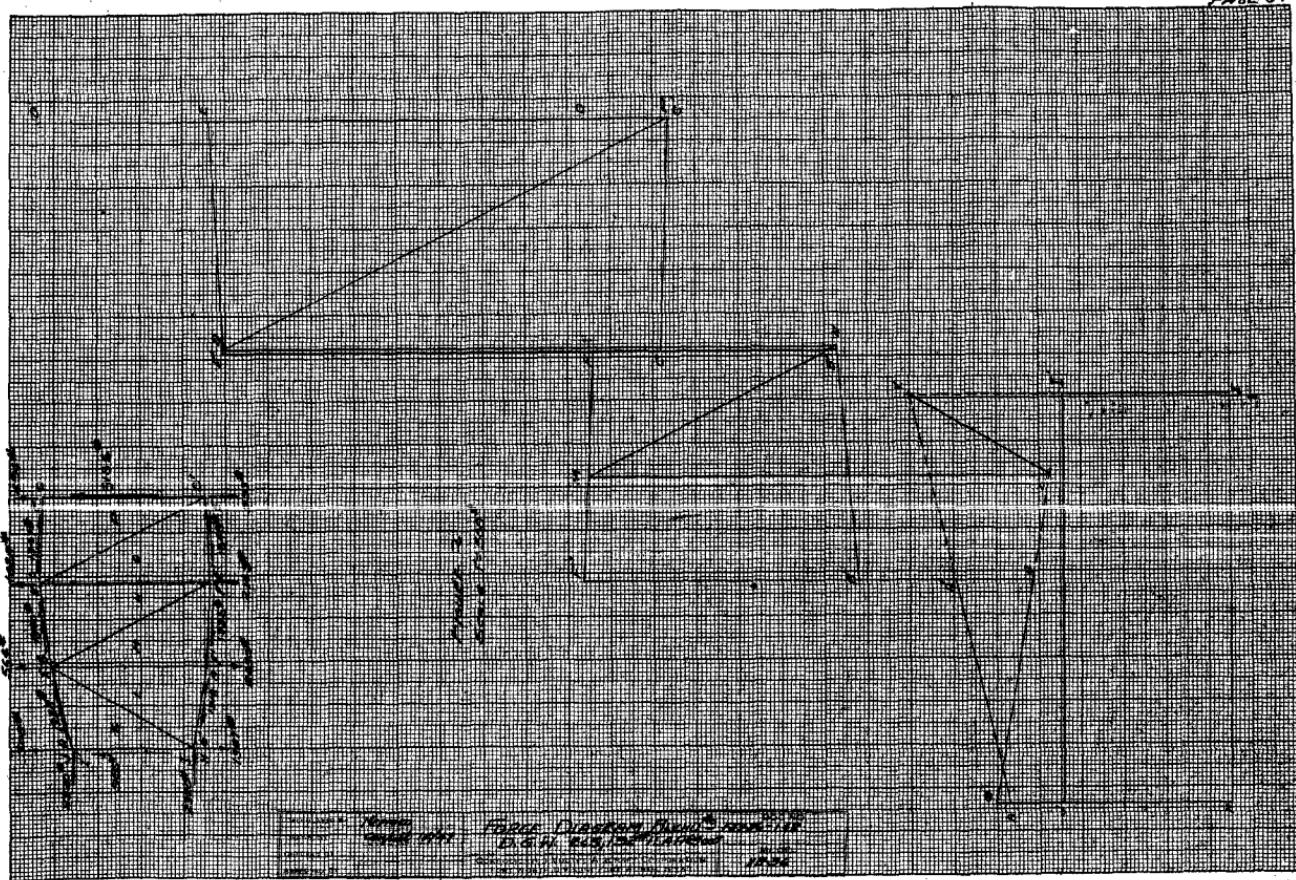
CORRECTED PANEL POINT LOADS

$$P_A = 308^{\prime\prime\prime}$$

$$P_D = 494^{\prime\prime\prime}$$

$$P_E = 993^{\prime\prime\prime}$$

$$P_D = 1387^{\prime\prime\prime}$$



ANALYSIS WING  
PREPARED BY W. J. Field  
CHECKED BY C. C. Field  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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BULKHEAD #3

CONDITION II - AGW (7.2-1000# BOMBS) HAA @ 5000'

$$N_L = 5420 \text{ ft}^4 \quad (\text{REF: TABLE XII})$$

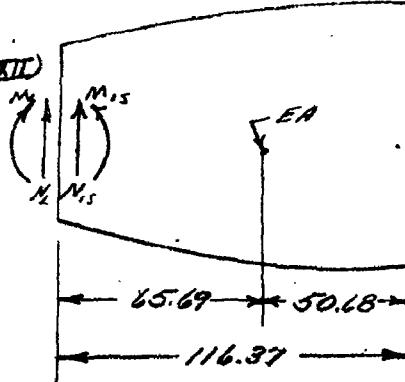
$$M_L = 128700 \text{ ft}^5$$

$$N_{LS} = 8287 \text{ ft}^4$$

$$M_{LS} = 424000 \text{ ft}^5$$

$$N_R = 7456 \text{ ft}^4$$

$$M_R = 394000 \text{ ft}^5$$



REACTIONS ON BULKHEAD

TRANSFERRING ALL EXTERNAL FORCES TO EA.

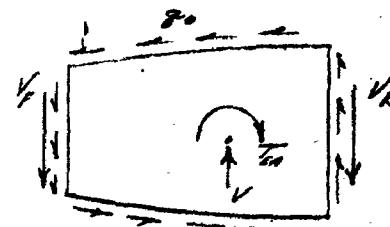
$$V = N_L + N_{LS} = 13707 \text{ ft}^4$$

$$T_{EA} = M_L + M_{LS} + 65.69 \times V = 604700 \text{ ft}^5$$

REACTIONS ON F.S.E.R.S. DUE TO V

$$V_R = \frac{65.69}{116.37} \times 13707 = 7730 \text{ ft}^4$$

$$V_F = 13707 - 7730 = 5977 \text{ ft}^4$$



SHEAR FLOW DUE TO T<sub>EA</sub>

$$q_0 = \frac{T_{EA}}{2A} = \frac{604700}{17830} = 33.9 \text{ ft}/\text{in.}$$

ANALYSIS WING  
PREPARED BY Mefford  
CHECKED BY Campfield  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. FZS-36-242  
MODEL XB-36  
DATE 11-47

A.G.W. (72-1000# BOMBS) HAA @ 5000' (CONT'D) BULKHEAD #3

CRUSHING LOAD

$$P = \frac{(M_i)^2 L}{I_Q EI}$$

$$M_i = 126.20 \times 10^6 \text{ (REF: TABLE 27, PG 102)}$$

FZS-36-240

$$L = 33.25''$$

$$I_Q = 75.75$$

$$E = 10.3 \times 10^6$$

$$I = 134,500 \text{ in}^4$$

REPLACE  $P$  WITH EQUIVALENT TRAPEZOID SUCH  
THAT  $\frac{h_f}{h_r} = \frac{w_f}{w_r}$  WHERE  $h_f$  &  $h_r$  ARE CONTOUR DEPTHS  
OF FRONT & REAR SPAR RESPECTIVELY.

$$w_f = 37.8$$

$$w_r = 48.9$$

AIR LOADS

REPLACING AIR LOADS WITH EQUIVALENT TRAPEZOID

COMPOSITE INTERSPAR LOAD ( $N_{IS}$ )

$$w_{fc} = 97.3 \text{ ft}$$

$$w_{rc} = 45.2 \text{ ft}$$

UPPER SURFACE LOAD

$$w_{fu} = 81.7 \text{ ft}$$

$$w_{ru} = 46.6 \text{ ft}$$

LOWER SURFACE LOADS

$$w_{fl} = 15.6 \text{ ft}$$

$$w_{rl} = -1.4 \text{ ft}$$

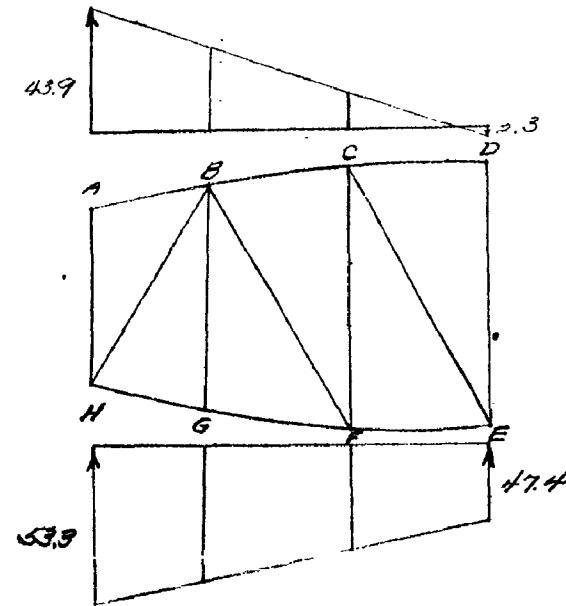
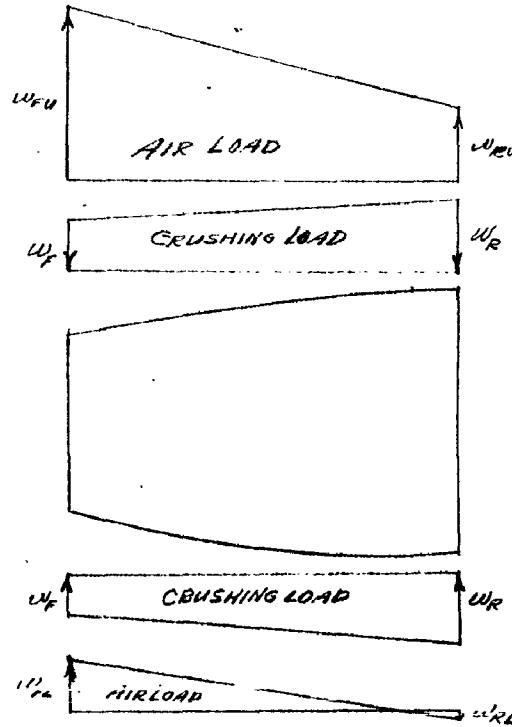
ANALYSIS WING  
PREPARED BY Zaytsev  
CHECKED BY Campfield  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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A.G.W. (72-1000# BOMBS), H.A.A @ 5000' (CONT'D)

COMBINED AIR & CRUSHING LOADS



COMBINED LOADS

BREAKDOWN OF NET AIR AND CRUSHING LOADS  
INTO PANEL POINT LOADS

$$P_A = 775 \text{ #}$$

$$P_E = 942 \text{ #}$$

$$P_B = 1044 \text{ #}$$

$$P_F = 1933 \text{ #}$$

$$P_C = 542 \text{ #}$$

$$P_G = 1976 \text{ #}$$

$$P_D = 59 \text{ #}$$

$$P_H = 1002 \text{ #}$$

ANALYSIS WING  
PREPARED BY M. J. Ford  
CHECKED BY Cahill  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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MODEL XB-36  
DATE 11-47

HGW (12-1000# BOMBS), HAA @ 5000' (CONT'D)

CORRECTION LOADS

CORRECTING LOADS ON FRONT AND REAR SPAR TO  
ACCOUNT FOR TRANSFER OF THE SHEAR FLOW FROM THE  
CONTOUR TO THE CENTROID OF THE STRAIGHT LINE  
CHORD MEMBER.

$$T_u = 2A_w g_0 = 20200 \text{ "##}$$

$$R_u = \frac{20200}{116.37} = \underline{173.5 \text{ "}}$$

$$T_L = 2A_L g_0 = 8950 \text{ "##}$$

$$R_L = \frac{8950}{116.37} = \underline{76.9 \text{ "}}$$

CORRECTED PANEL POINT LOADS

$$P_A = 601 \text{ "#}$$

$$P_B = 233 \text{ "#}$$

$$P_C = 1019 \text{ "#}$$

$$P_H = 925 \text{ "#}$$

ANALYSIS *Wing*  
PREPARED BY *Jefford*  
CHECKED BY *Engel*  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. *EFS-36-242*  
MODEL *XB-36*  
DATE *11-47*

BULKHEAD #3

CONDITION III. AGC (72-1000# BOMBS) L/H @ 5000'

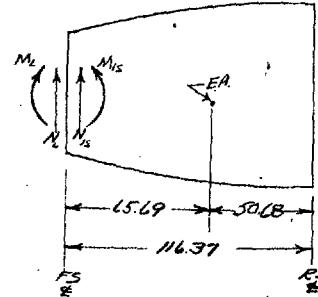
$$N_c = 4060 \text{ "#}$$
 (REF TABLE III)

$$M_c = 9,250 \text{ "#}$$

$$N_s = 8,500 \text{ "#}$$

$$M_s = 46,500 \text{ "#}$$

$$N_u = 11,100 \text{ "#}$$



REACTION ON BULKHEAD

TRANSFERRING ALL EXTERNAL FORCES TO E.A.

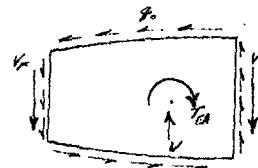
$$V - N \cdot I_N = 11,510 \text{ "#}$$

$$T_EA = M_c + M_s + 65.69 \times V = 454,750 \text{ "#}$$

REACTIONS ON F.S. & R.S. DUE TO V

$$V_R = \frac{65.69}{116.37} \times 12560 = 7080 \text{ "#}$$

$$V_F = 12560 - 7080 = 5480 \text{ "#}$$



SHEAR FLOW DUE TO T\_EA

$$\begin{aligned} g_0 &= \frac{T_EA}{2A} \\ &= \frac{454,750}{17,830} = 25.5 \text{ "#/in} \end{aligned}$$

ANALYSIS WING  
PREPARED BY Zifford  
CHECKED BY Campbell  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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BULKHEAD #3

AG.W. (72-1000# BOMBS) LAA @ 5000' (CONT'D)

CRUSHING LOAD

$$P = \frac{(M'_x)^2 L}{I_Q EI}$$

$$M'_x = 132.41 \times 10^6 \text{ (F25-36-240)}$$
$$L = 33.25$$

$$P = 5530 \text{ #}$$

REPLACE  $P$  WITH EQUIVALENT TRAPEZOID SUCH  
THAT  $\frac{w_f}{w_r} = \frac{w_f}{w_r}$  WHERE  $w_f$  &  $w_r$  ARE THE CONTOUR  
DEPTHS OF FRONT & REAR SPARS RESPECTIVELY.

$$w_f = 41.4$$

$$w_r = 53.6$$

AIR LOAD

REPLACING THE AIR LOADS WITH EQUIVALENT  
TRAPEZOIDS.

COMPOSITE INTERSPAR LOAD

$$w_{fc} = 87.3 \text{ #/in}$$

$$w_{rc} = 58.9 \text{ #/in}$$

UPPER SURFACE LOAD

$$w_{fu} = 102.5 \text{ #/in} \dagger$$

$$w_{ru} = 88.1 \text{ #/in} \dagger$$

LOWER SURFACE

$$w_{fl} = 15.2 \text{ #/in} \dagger$$

$$w_{rl} = 29.2 \text{ #/in} \dagger$$

ANALYSIS WING  
PREPARED BY Murphy  
CHECKED BY Campfield  
REVISED BY \_\_\_\_\_

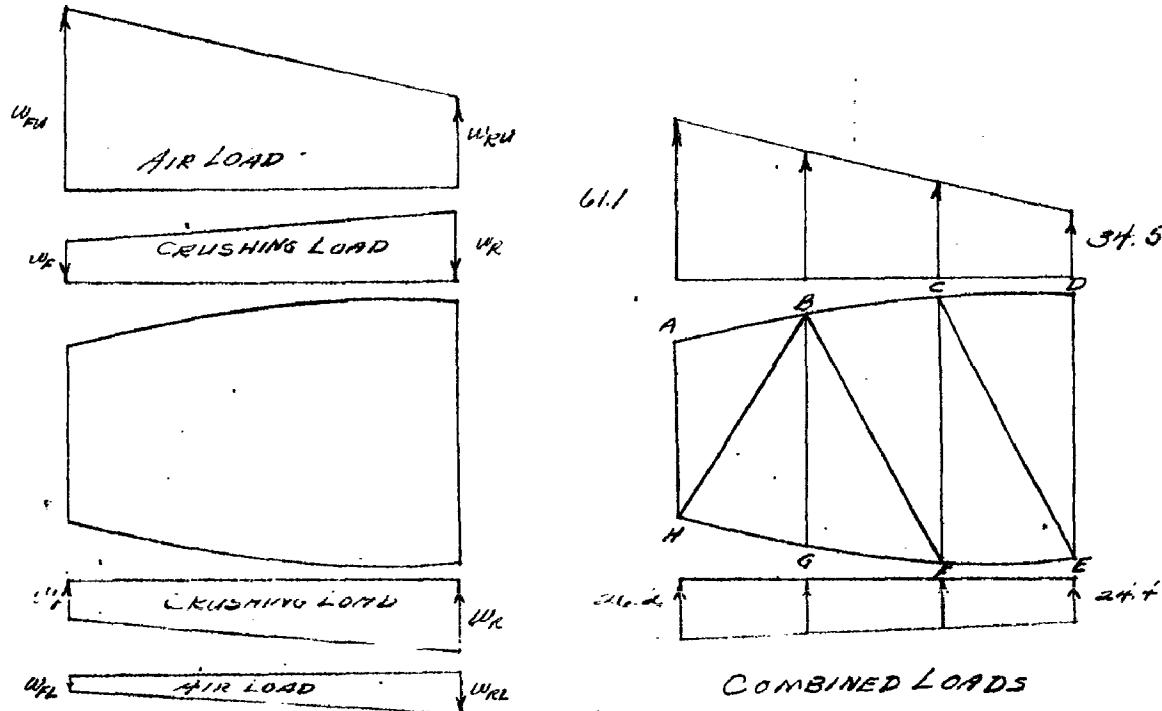
Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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MODEL XB-36  
DATE 11-47

BULKHEAD #3

AGW(72-1000" BOMBS) LAA @ 5000' (CONT'D)

COMBINED AIR & CRUSHING LOADS



BREAKDOWN OF NET AIR AND CRUSHING LOADS  
INTO PANEL POINT LOADS.

$$P_A = 1110 \text{ "#↑}$$

$$P_B = 2015 \text{ "#↑}$$

$$P_C = 1706 \text{ "#↑}$$

$$P_D = 739 \text{ "#↑}$$

$$P_E = 485 \text{ "#↑}$$

$$P_F = 978 \text{ "#↑}$$

$$P_G = 984 \text{ "#↑}$$

$$P_H = 493 \text{ "#↑}$$

ANALYSIS WING  
PREPARED BY M. F. H.  
CHECKED BY P. J. Field  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

PAGE 2  
REPORT NO. F25-36-242  
MODEL XB-36  
DATE 11-47

BULKHEAD #3

A.G.W. (2-1000# BOMBS) LAA @ 5000' (CONT'D)

CORRECTION LOADS

CORRECTING LOADS ON FRONT AND REAR SPAR TO  
ACCOUNT FOR TRANSFER OF THE SHEAR FLOW FROM  
THE CONTOUR TO THE CENTROID OF THE STRAIGHT  
LINE CHORD MEMBER.

$$T_u = 2A_u g_0 = 15,200^{\text{#}}$$

$$R_u = \frac{T_u}{116.37} = 130.5^{\text{#}}$$

$$T_l = 2A_l g_0 = 6740^{\text{#}}$$

$$R_l = \frac{T_l}{116.37} = 57.8^{\text{#}}$$

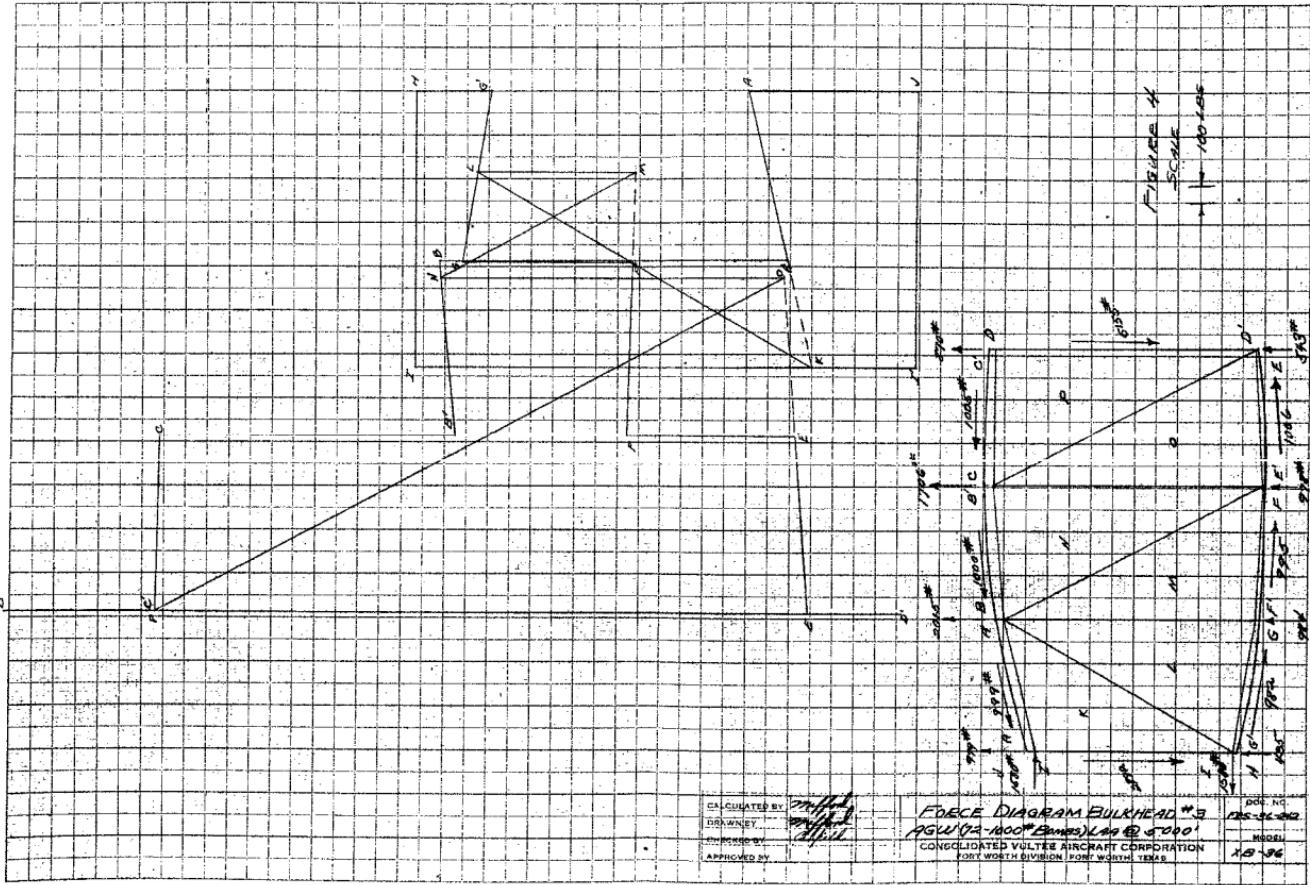
CORRECTED PANEL POINT LOADS.

$$P_A = 979^{\text{#}}$$

$$P_D = 870^{\text{#}}$$

$$P_E = 543^{\text{#}}$$

$$P_H = 435^{\text{#}}$$



CALCULATED BY  
DRAWN BY  
APPROVED BY

PROJ.  
11/11/11

FORCE DIAGRAM BULKHEAD #3  
AGW/04 10007/2011/09 @ 5200'  
CONOLIDATED VULTEE AIRCRAFT CORPORATION  
FORT WORTH DIVISION FORT WORTH, TEXAS

DOC. NO.  
FBS-36-242  
RECORDED  
X-14

CONSOLIDATED VULTEE AIRCRAFT CORPORATION  
FORT WORTH DIVISION

FORT WORTH, TEXAS

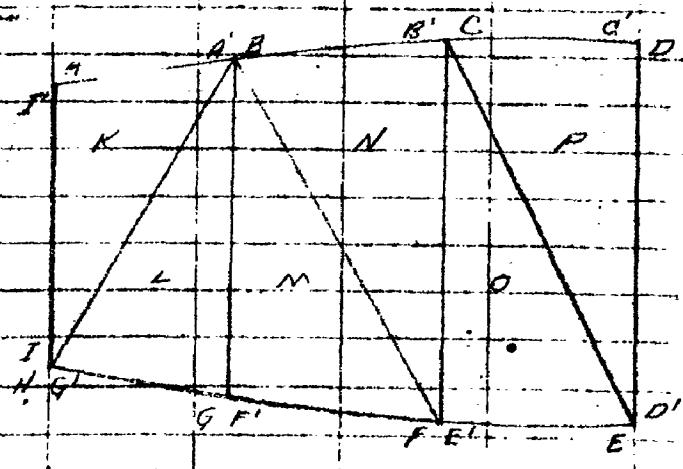
PW 639 125 PADS 11-43

TABLE XII. SUMMARY OF MEMBER LOADS 11-47

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MEMBER LOADS 11-47

MEMBER	CONDITION			CRITICAL LOAD	
	DGW	M.G.W.	AGW	TEN	COMP.
	L.A.A.	H.A.A.	L.A.A.		
FIG 2					
FIG 3					
FIG 4					
AK	+2440	-2300	-624	2440	2300
A'K	+1105	-970	-625	1105	970
BN	+1365	-685	-100	1365	685
B'N	+25	+640	+900	900	-
CP	+1350	-1330	-1005	1350	1330
C'P	0	0	0	0	0
DP	+439	+233	+870	870	-
D'P	+3679	-4935	+4320	3679	4935
E0	+1325	-1980	-1916	1325	1980
E'0	-25	-690	-910	-	910
FM	+730	-1373	-1510	730	1510
F'M	-610	-50	-515	-	610
GL	-615	-55	-530	0	615
G'L	-1928	+1255	+1632	1255	-1928
I'K	+1875	-2975	-2292	1875	2475
I'K	+635	+35	+600	635	-
KL	-940	+2030	+2285	2230	940
LM	+2210	-1970	-915	2710	1970
MN	-1640	+1595	+225	1595	1640
NO	+3590	-3250	-1985	3590	3250
OP	-2920	+4270	+1115	4270	2920



RS 8f: *mofford*  
CHANGED BY: *J.W. Dorn*

ANALYSIS WING  
PREPARED BY W.H. Ford  
CHECKED BY J. E. Miller  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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DATE 5-48

WING BULKHEAD #3  
DETAIL ANALYSIS

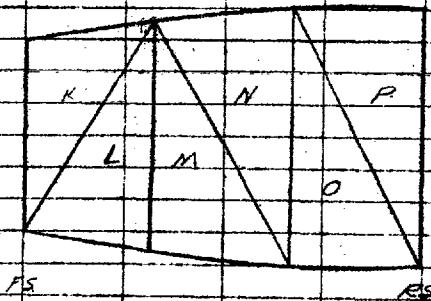
THE DETAIL ANALYSIS OF THE XB-36 BULKHEAD #3 WILL BE ACCOMPLISHED IN THE SAME MANNER AS THE YB-36 & B-36A ANALYSIS, REF F25-36-142. DUE TO THE SIMILARITY OF THE TWO BULKHEADS THE ONLY DIFFERENCE BEING IN THE TRUSS TUBE END CHANNELS AND CONNECTIONS, THE SAME MEMBERS ARE CRITICAL FOR THE XB-36 THAT WERE CRITICAL FOR THE B-36A (REF: P-I 181 F25-36-141), AND WILL BE CHECKED IN THIS ANALYSIS.

CONSOLIDATED VULTEE AIRCRAFT CORPORATION TABLE II MARGINS OF SAFETY OF TRUSS  
FORT WORTH DIVISION FORT WORTH, TEXAS

PW 633 123 PAGE 11-49

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12536-242  
DATE 11-97

1	2	3	4	5	6	7	8	9	10	11	
MEMBER	SIZE	MAX AREA	S.F.	L	I	P	L/P	F <sub>C</sub>	M.S.		
TYPE	TYPE	"	" <sup>1/2"</sup>	(INCHES)							
	THE III	.60				10%					
KL	.051 1/2 x 1/2	-940	.366	-2570	72.000	1586	.658	109.5	7200	+1.80	
LM	.051 2 x 1/2	-1370	.404	-4880	68.00	2627	.806	82.7	12700	+1.60	
MN	.050 1/2 x 1/2	-1640	.2895	-5670	72.75	1519	.725	107.2	7500	+ .32	
NO	.050 2 1/2 x 2	-3250	.388	-8380	74.00	3496	.941	78.5	14000	+ .67	
OP	.050 2 1/2 x 2	-2920	.388	-7520	80.06	3496	.941	85.1	13000	+ .59	



\* TRUSS TUBE COLUMN ALLOWANCES FROM  
FIG. I-10 P-I-02 F25-36-142

BY *[Signature]*  
CHECKED BY *[Signature]*

ANALYSIS WING  
 PREPARED BY Carlyle  
 CHECKED BY Carlyle  
 REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
 FORT WORTH DIVISION  
 FORT WORTH, TEXAS

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 REPORT NO. F25-36-242  
 MODEL XB-36  
 DATE 12/47

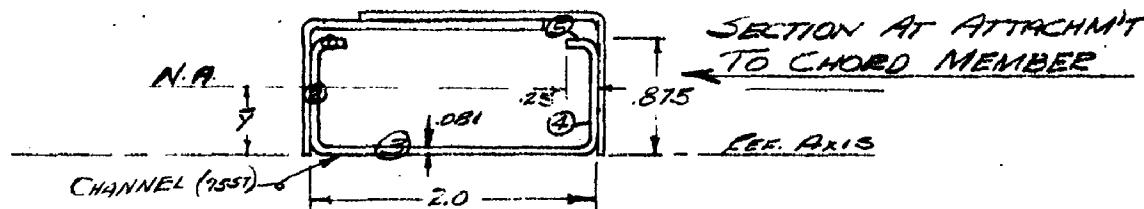
OKHO #3

DETAIL ANALYSIS

ANALYSIS OF MEMBER "NO" END ATTACHMENT

ITEM	AREA	Y	AY	AY <sup>2</sup>	I <sub>o</sub>
①	.0138	.834	.0115	.0096	0
②	.0580	.438	.0254	.0111	.0024
③	.1489	.040	.0059	.0002	0
④	.0580	.938	.0254	.0111	.0024
⑤	.0138	.838	.0115	.0096	0
TOTAL	.1850		.1540	.1470	.0040
	.4775		.2337	.1886	.0088

REF F25-36-143 p I-183



$$\bar{Y} = \frac{\sum AY}{\sum A} = \frac{.2337}{.4775} = .489 \text{ IN.}$$

$$\bar{Y}_t = .489 \text{ IN.} \quad Y_c = .637 \text{ IN.}$$

$$I = \sum AY^2 + I_o - \sum A \bar{Y}^2 = .1886 + .0088 - (.4775)(.489)^2 = .0834 \text{ IN.}^4$$

THE MAXIMUM LOAD "P" IS 3,550# (REF. p. 45)

$$f_t = \frac{P}{A} + \frac{(F_e) Y_c}{I} = \frac{3550}{.4775} + \frac{(3550 \times .489)(.489)}{.0834} = 17810 \#/IN^2$$

$$F_e = .70(70000) = 49000 \#/IN^2 (\text{REF. F25-36-142, p I-184})$$

$$M.S. = \frac{49000}{17810} - 1 = +1.75$$

ANALYSIS WING  
PREPARED BY Campfield  
CHECKED BY Mofford  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. FES-36-242  
MODEL XB-36  
DATE 12/47

BURHD #3

END ATTACHMENT OF "NO"

THE ATTACHMENT OF THE CHANNEL INSERT  
(-9 CHANNEL) TO THE CHORD MEMBER  
IS CRITICAL, AND THE (8) 3/16" ALST RIVETS  
ARE CRITICAL IN SHEAR.

$$M.S. = \frac{8 \times 860}{3590} - 1 =$$

+ .92

ANALYSIS OF MEMBER "OP"

SINCE MEMBER "OP" OF THE XB-36 AIRPLANE  
IS OF THE SAME MATERIAL AND THE SAME  
SIZE AS THE CORRESPONDING MEMBER ON THE B-36A  
AIRPLANE, THIS ANALYSIS WILL BE DONE BY A RATIO  
OF THE TWO LOADS.

$$P_{B-36} = 4560^*$$

$$P_{XB-36} = 4270 \text{ (REF. P. 15)}$$

$$f_t = \frac{4270}{4560} \times 24730^* = 23,200 \text{#/in}^2$$

$$F_t = .7 \times 70,000 = 49,000 \text{#/in}^2^*$$

$$M.S. = \frac{49000}{23200} - 1 =$$

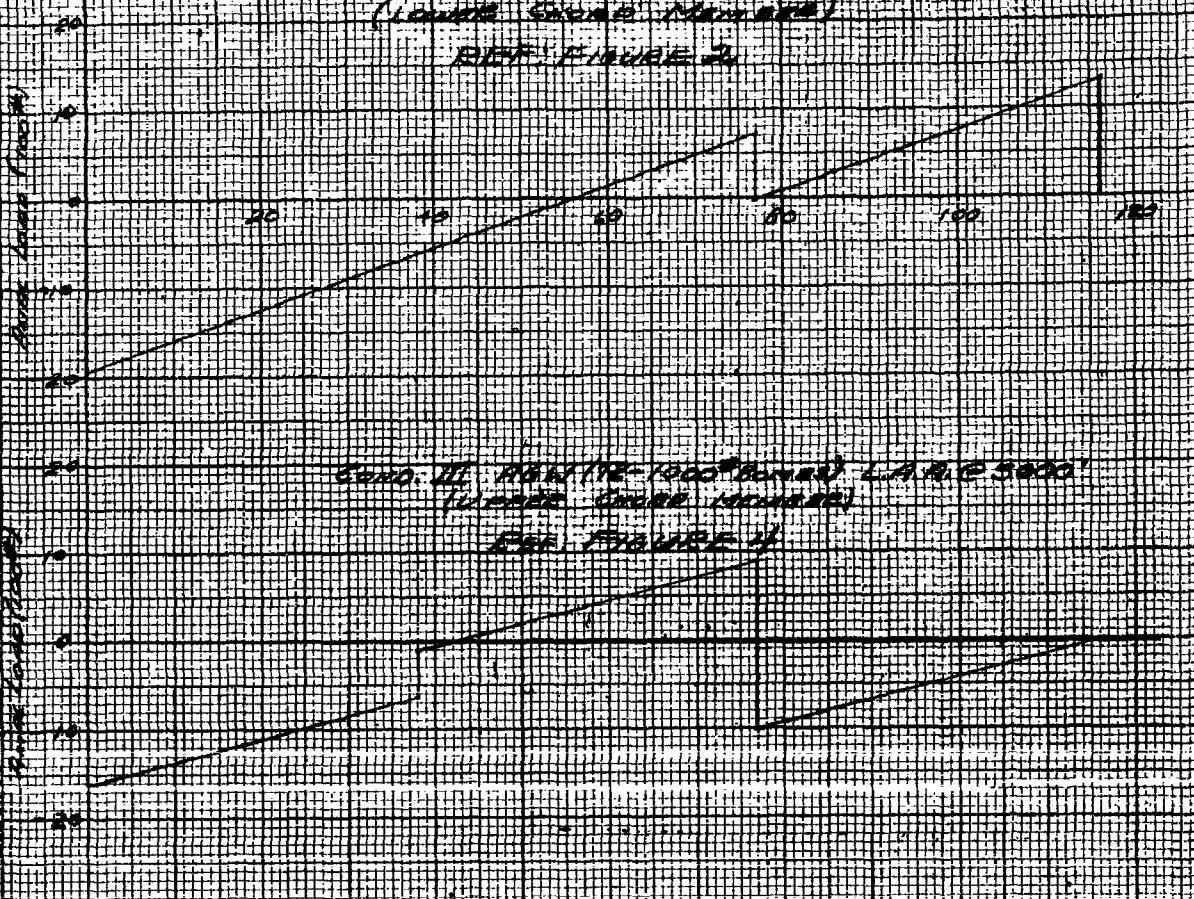
+ 1.11

\* REF. FES-36-142, P. I-184 & I-185

Curve 2 (Span 100', 33' 0" H. A. 5000')

(Lower chord members)

FIGURE 2



Curve 4 (Span 100', 33' 0" H. A. 5000')

(Upper chord members)

FIGURE 4

**CRITICAL MAX LOADS FOR UPPER  
AND LOWER CHORD MEMBERS**

Calculated by

Span 100'

H.A. 5000'

C. 33' 0"

L. 100'

FIGURE 5

Drawing No.

ECLIPSE 75

Date

10/10/80

Year

CONTINUING MILLS ANCHOR CORPORATION  
BOSTON, MASSACHUSETTS 02110 U.S.A.

ANALYSIS WING  
PREPARED BY Campfield  
CHECKED BY W.H. Jones  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

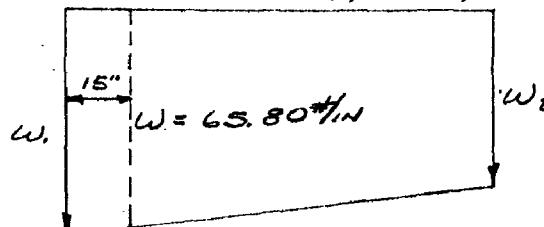
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REPORT NO. F25-36-242  
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DATE 12/47

BLKHO #3

ANALYSIS OF LOWER CHORD MEMBER

DEW ILLAGE 5,000' CONDITION

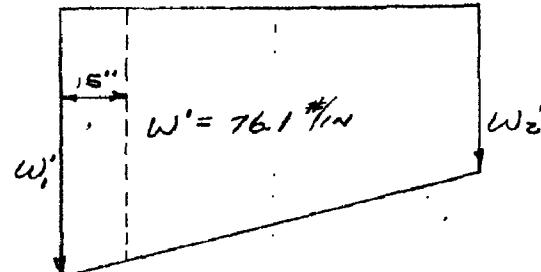
L.S. LOADING (B-36A)



$$W_1 = 71.29 \text{#/in}$$

$$W_2 = 28.73 \text{#/in}$$

L.S. LOADING (XB-36)



$$W_1 = 81.10 \text{#/in}$$

$$W_2 = 42.25 \text{#/in}$$

Critical section occurs at 15" aft of F.S. (Ref. F25-36-142 p I-197)

Axial Load = 1460# (Ref. p 50)

M<sub>B-36A</sub> = 7600 in# (Ref. F25-36-142 p I-196)

$$M = \frac{W'}{W} \times M_{B-36A} = \frac{76.1}{65.8} \times 7600 = 8800 \text{ in#}$$

$$A = 2.586 \text{ in}^2; Y_c = 5.83 \text{ in}; I = 7.36 \text{ in}^4$$

(Ref. F25-36-142, p I-192)

$$F_c = \frac{P}{A} + \frac{M Y_c}{I} = \frac{1460}{2.586} + \frac{8800 \times 5.83}{7.36} \\ = 7525 \text{#/in}^2$$

$$F_c = 25,000 \text{#/in}^2 (\text{Ref. F25-36-142, p. I-197})$$

$$M.S. = \frac{25000}{7525} - 1 =$$

+2.32

ANALYSIS OF UPPER INTERCOSTAL

From F25-36-142 (P.I-98) it was found that the intercostal just forward of the first panel point to be critical for the combined effects of transverse shear and axial load.

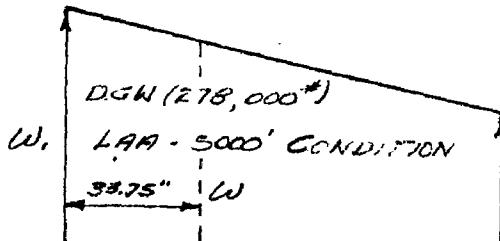
ANALYSIS WING  
 PREPARED BY Carey J. L.  
 CHECKED BY Murphy  
 REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation

FORT WORTH DIVISION  
 FORT WORTH, TEXAS

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BLKHD #3

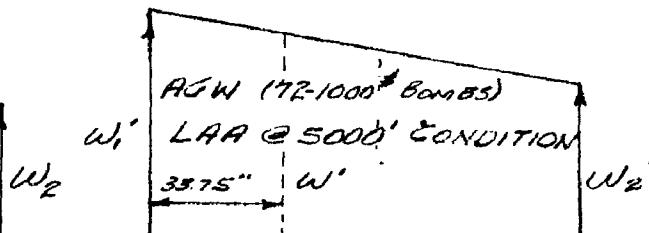


U.S. LOADING (B-36A)

$$W_1 = 66.59 \text{#/in}$$

$$W_2 = 31.14 \text{#/in}$$

$$W = 56.30 \text{#/in}$$



U.S. LOADING (XB-36)

$$W_1' = 61.1 \text{#/in}$$

$$W_2' = 34.5 \text{#/in}$$

$$W' = 53.5 \text{#/in}$$

$$\begin{aligned} \text{AVERAGE TRANSVERSE SHEAR} &= \frac{W'}{W} \times \text{VAVE (B-36A)} \\ &= \frac{53.5}{56.3} \times 1108^* \\ &= 1060^* \end{aligned}$$

THE INTERCOSTAL LOAD DUE TO TRANSVERSE

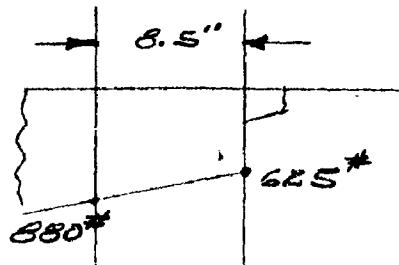
$$\text{SHEAR} = \frac{VQ}{I} 8.5^* = \frac{1060 \times 1.012 \times 8.5}{5.45} = 1680^*$$

THE INTERCOSTAL LOAD DUE TO THE CHORD MEMBER AXIAL LOAD IS THE DIFFERENCE BETWEEN  $P_{1L}$  AND  $P_{2L}$  AS SHOWN ON THE ACCOMPANYING SKETCH, WHERE:

$$P_{1L} = P_1 \frac{A_L}{A_{TOTAL}} = 880 \frac{.374}{.874} = 376^*$$

$$P_{2L} = P_2 \frac{A_L}{A_{TOTAL}} = 625 \frac{.374}{.874} = 268^*$$

$$P_{1L} - P_{2L} = 376 - 268 = 108^*$$



$$\begin{aligned} \text{TOTAL INTERCOSTAL LOAD} &= 1680^* + 108^* \\ &= 1788^* \end{aligned}$$

$$f_s = \frac{1788}{66} = \frac{1788}{[3.3 - 3(\frac{3}{16})] \cdot 0.51} = 12800 \text{#/in}^2$$

\* (REF. F25-36-142, p I-199)

ANALYSIS WING  
PREPARED BY G. G. J. L.  
CHECKED BY M. Ford  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. FZS-36-142  
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BLKHO #9

$$F_{CR} = 28000 \text{ lb/in}^2 \text{ (Ref. FZS-36-142, p I-201)}$$

$$M.S. \text{BUCKLING} = \frac{28000}{12800} - 1 =$$

+1.18

ANALYSIS WING  
PREPARED BY Taylor  
CHECKED BY McLeod  
REVISED BY

Consolidated Vultee Aircraft Corporation

FORT WORTH DIVISION  
FORT WORTH, TEXAS

PAGE 54  
REPORT NO. FES-54-242  
MODEL XB-36  
DATE 4-28-48

BULKHEAD NO. 13 (36W.113)

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ANALYSIS Wing  
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FORT WORTH, TEXAS

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DATE 5 - 48

WING BULKHEAD #13  
(36W113)

INTRODUCTION

For all practical purposes Bulkhead #13 of the XB-36 is the same as Bulkhead #13 of the B-36A. A detailed discussion of the location, purpose, and method of analyzing Bulkhead #13 is given on page I-206 of FZS-36-142.

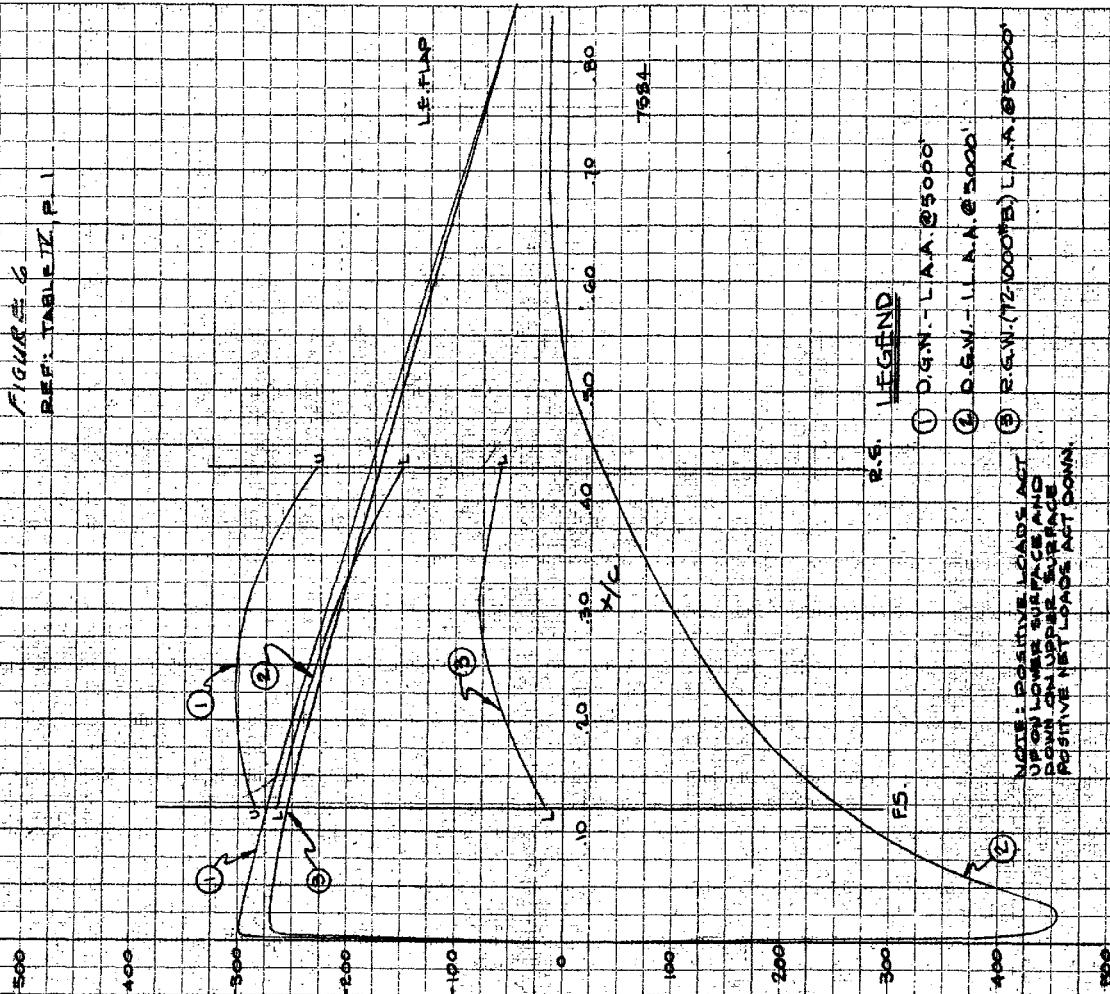
A survey of design conditions resulted in the selection of three flight conditions as critical conditions for the design of this bulkhead:

1. D.G.W. LAA @ 5000'
2. D.G.W. ILAA @ 5000'
3. R.G.W. (72-1000# Bombs) LAA @ 5000'

This analysis includes:

1. Analysis of truss & their end attachments, Ref. page 86
2. Chord member analysis, which is accomplished by comparison with B-36A data.
3. Intercostal analysis; by use of B-36A data.

FIGURE 6  
 REF: TABLE II P. 1



CALCULATED BY  
 DRAWN BY  
 CHECKED BY  
 APPROVED BY

*B. C. Bell*  
*B. C. Bell*  
*M. J. M.*

FIG. 6  
 CONSOLIDATED VULTEE AIRCRAFT CORPORATION  
 FORT WORTH DIVISION, FORT WORTH, TEXAS

DOC NO.  
 FES-36-242  
 MODEL  
 XB3G



CONSOLIDATED VULTEE AIRCRAFT CORPORATION TABLE XII  
PORTWORTH DIVISION PORTWORTH, TEXAS

b = 56.375" c = 310.471"

FW 821 123 PAGE 11-45

DISTANCE FROM LE P % / CHORD (LIM. R)

S. M. S. (2 X 3)

MOMENT MULTIPLIER (4 X 5)

FIG. 6  
COMPOSITE INTERSPAR AIR LOADS

43,000 -179 1 -79 8 -1432

39,125 -192 4 -768 7 -5376

35,250 -204 2 -408 6 -2448

31,375 -216 4 -864 5 -4320

27,500 -228 2 -456 4 -1824

23,625 -240 4 -960 3 -2880

19,750 -251 2 -502 2 -1004

15,875 -262 4 -1048 1 -1048

12,000 -273 1 -273 0 0

2 5458 -20332

$$N_{15} = 1.5bC [0.3875(-5458)] = -8283 \#$$

$$144 3$$

$$M_{15,MS} = 1.5bC [0.3875(-20332)] = -37,936 \#$$

$$144 3$$

$$\bar{x} = \frac{-27,936}{8283} = 44.843" \text{ AFT F.S.}$$

COMPUTATION OF N<sub>15</sub>, N<sub>U</sub>, M<sub>15</sub> & M<sub>U</sub> FOR AIRLOADS  
STATION 13 - DGW 1265 192° - L.A.A. @ 5000

PAGE 11  
REPORTING PER AIRLOAD  
MODEL X-55  
DATE 1/47

DISTANCE FROM LE P % / CHORD (LIM. R)

S. M. S. (3 X 5)

MOMENT MULTIPLIER (10 X 11)

FIG. 6  
UPPER SURFACE INTERSPAR AIR LOADS

43,000 -229 1 -229 8 -1832

39,125 -254 4 -1016 7 -712

35,250 -274 2 -548 6 -3288

31,375 -289 4 -1156 5 -5730

27,500 -298 2 -596 4 -2384

23,625 -303 4 -1212 3 -3636

19,750 -301 2 -602 2 -1204

15,875 -295 4 -1180 1 -1180

12,000 -285 1 -285 0 0

2 6924 -26412

$$N_U = 1.5bC [0.3875(-6924)] = -10,460 \#$$

$$144 3$$

$$M_{15,MS} = 1.5bC [0.3875(-26412)] = -434,000 \#$$

$$144 3$$

$$\bar{x} = \frac{-434,000}{46,200} = 46.200" \text{ AFT F.S.}$$

\* DEFINITION OF TERMS

N<sub>15</sub>-TOTAL (UPPER & LOWER SURFACE) INTERSPAR AIR LOAD SHEAR.

N<sub>U</sub>-TOTAL (UPPER & LOWER SURFACE) INTERSPAR AIR LOAD MOMENT

M<sub>15</sub>-INTERSPAR AIRLOAD SHEAR (UPPER SURFACE AIRLOAD)

M<sub>U</sub>-INTERSPAR AIRLOAD MOMENT (UPPER SURFACE AIRLOAD)

NOTE: SIGNS (+OR-) FOLLOW THOSE USED FOR PRESSURE DISTRIBUTION AND HAVE NO CONSISTENT MEANING WITH RESPECT TO FORCES, THEREFORE, DIRECTION OF FORCES IS INDICATED BY ARROWS, NOT BY SIGNS.

SAC: BY: *[Signature]*  
CHKD: BY: *[Signature]*

**CONSOLIDATED VULTEE AIRCRAFT CORPORATION TABLE XVIII**  
FORT WORTH DIVISION FORT WORTH, TEXAS  $D = 36.375"$ ,  $C = 31047"$

COMPUTATION OF N.N.T.M. & M.F. FOR AIR LOADS  
STATION 3 D.G.W. 205 192 - 1 AA @ 5000'

PORT WORTH DIV.

**THE AIRCRAFT CORP.** MANUFACTURERS OF AIRPLANES

卷之三十一

STATION F-B-S-N-145-825 144-050001

$$M_L = 1.5bc^2 \cdot 3630 \cdot (0.2)^2 + 1.6170 = 4101.192 \text{ Nm}$$

1211 = 157.94° AFT R.S.  
1400

\* FOR DEFINITION OF TERMS SEE PAGE 57

---

**NOTE**

SIGNS (+ OR -) EQUATE TO THESE USES

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HAVE NO CONSISTENT MEANING WITH RESPECT TO FORCES, THEREFORE  
DIRECTION OF FORCES IS INDICATED BY ARROWS, NOT BY SIGNS.

CALC. BY: L. Clegg  
CHKD. BY: mjt

TABLE XIX

COMPUTATIONS OF  $N_s$ ,  $N_u$ ,  $M_s$ ,  $S.M.$  FOR AIR LOADS  
STATION 15 DGW-2GS.197-11A.A.65600

REPORT NO. FES-162  
MODEL X-5  
DATE 1/4/61

DISTANCE FROM LE	$D^2/b$	S.M.s	$\odot \times \odot$	MOMENT MULTIPLIER	$\odot \times \odot$
% CHORD (UNIT)					

FIG. 6

COMPOSITE INTERSPAR AIR LOADS

$43.000 + 35$	1	35	8	1280	$43.000 - 149$	1	-149	3	-1192
$39.125 + 53$	4	212	7	1484	$39.125 - 171$	4	-684	7	-4788
$35.250 + 73$	2	146	6	876	$35.250 - 190$	2	-380	6	-2280
$31.375 + 93$	4	372	5	1860	$31.375 - 206$	4	-824	5	-4120
$27.500 + 116$	2	232	4	928	$27.500 - 220$	2	-440	4	-1760
$23.625 + 142$	4	568	3	1704	$23.625 - 232$	4	-928	3	-2784
$19.750 + 174$	2	348	2	696	$19.750 - 244$	2	-488	2	-976
$15.875 + 212$	4	848	1	848	$15.875 - 255$	4	-1020	1	-1020
$12.000 + 259$	1	259	0	0	$12.000 - 294$	1	-264	0	0
$\Sigma$		$\Sigma 3020$		$\Sigma 8676$	$\Sigma$	$\Sigma -5177$			$\Sigma 18920$

$$N_s = \frac{1.5bc}{144} \left[ \frac{0.3875(3020)}{3} \right] = +4604^{\#}$$

$$N_u = \frac{1.5bc}{144} \left[ \frac{0.3875(-5177)}{3} \right] = -7366^{\#}$$

$$M_s = \frac{1.5bc^2}{144} \left[ \frac{0.3875^2(8676)}{3} \right] = +158719^{\#} \quad M_u = \frac{1.5bc^2}{144} \left[ \frac{0.3875^2(-18920)}{3} \right] = -346141^{\#}$$

$$\bar{x} = \frac{158719}{2604} = 34.476 \text{ AFT. P.S.}$$

$$\bar{x} = \frac{-346141}{-7866} = 44.005 \text{ AFT. P.S.}$$

NOTE: SIGNS (+ OR -) FOLLOW THOSE USED FOR PRESSURE DISTRIBUTION AND HAVE NO CONSISTENT MEANING WITH RESPECT TO FORCES, THEREFORE, DIRECTION OF FORCES IS INDICATED BY ARROWS, NOT BY SIGNS.

\* FOR DEFINITION OF TERMS SEE P. 57

CALC. BY: *R. L. C.*  
CHECKED BY: *J. H. S.*

TABLE IX  
COMPUTATION OF  $N_L$ ,  $N_M$  &  $M_L$  FOR AIR LOADS  
STATION 13 R.G.W. (72-1000# BOMBS) L.A.A. @ 5000

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REPORT NO P25-3627-2  
MODEL X-533  
DATE 11/67

1	2	3	4	5	6
DISTANCE FROM LE % CHORD (LIMIT)	10 <sup>#</sup> / <sub>%</sub>	AVERAGE Δ AREA	DIST. TO Δ MOMENT C.G. FROM ABOUT 1/2% LINE (% LINE)		
FIG. 6	5K.01	10	4X5		

LEADING EDGE AIR LOADS

0	0	-180	-180	1133	-2048
1	-268	-269	-2.69	.105	-2324
2	-270	-270	-2.70	.095	-2564
3	-269	-269	-2.69	.085	-2286
4	-268	-268	-2.68	1	-2.68
$\Sigma$		-9.38		-9.22	

$$P^{\#}/\% \quad S.M.s \quad \begin{matrix} \textcircled{2} \times \textcircled{3} \\ \textcircled{4} \times \textcircled{5} \end{matrix} \quad \text{MOMENT MULTIPLES}$$

5	-266	1	-268	4	-1072
6	-265	4	-1000	3	-3180
7	-264	2	-524	2	-1048
8	-264	2	-524	2	-1048
9	-265	4	-1000	3	-3180
10	-254	4	-1032	1	-1032
11	-253	1	-253	0	0
$\Sigma$			-3137		-6332

$$N_L = \frac{1.5bc}{144} \left[ -2947(0.04105) \right] = -4741^{\#}$$

$$M_L = \frac{1.5bc^2}{144} \left[ -3137(0.02) - 9.88 \right] = -3622^{\#}$$

$$M_L = \frac{1.5bc^2}{144} \left[ -6332(0.02)^2 - 9.722 \right] = -66396^{\#}$$

7	8	9	10	11	12
DISTANCE FROM LE % CHORD (LIMIT)	10 <sup>#</sup> / <sub>%</sub>	S.M.s	$\textcircled{2} \times \textcircled{3}$	MOMENT MULTIPLIER	$\textcircled{10} \times \textcircled{11}$
FIG. 6	10				

TRAILING EDGE AIR LOADS

7	8	9	10	11	12
75.840	-75	1	-75	8	-600
71.735	-87	4	-348	7	-2436
67.630	-99	2	-193	6	-1188
63.525	-111	4	-244	5	-2220
59.420	-123	2	-246	4	-984
55.315	-135	4	-540	3	-1620
51.210	-147	2	-294	2	-582
47.105	-158	4	-632	1	-632
43.000	-170	1	-170	0	0
$\Sigma$			-2947		-10268

$$N_T = \frac{1.5bc}{144} \left[ -2947(0.04105) \right] = -4741^{\#}$$

$$M_T = \frac{1.5bc^2}{144} \left[ -10268(0.04105) \right] = -210824^{\#}$$

$$X = \frac{-210824}{4741} = 44.472 \text{ AFT B.S.}$$

\* FOR DEFINITION OF  
TERMS SEE P. 57

$$X = \frac{G_0 B_0 T_0}{b^2} = 8.34 \text{ FWD F.S.}$$

NOTE: SIGNS (+ OR -) FOLLOW THOSE USED FOR PRESSURE DISTRIBUTION AND  
HAVE NO CONSISTENT MEANING WITH RESPECT TO FORCES, THEREFORE,  
DIRECTION OF FORCES IS INDICATED BY ARROWS, NOT BY SIGNS.

CALC. BY: *[Signature]*  
CHCKD. BY: *[Signature]*

CONSOLIDATED VULTEE AIRCRAFT CORPORATION  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

TABLE XXI  
 $b = 36.375'$ ,  $C = 310.47"$

PW 832 125 PAGES 11-48

COMPUTATION OF \*  $N_x$ ,  $N_y$ ,  $M_x$ ,  $E$ ,  $M_y$  FOR AIRLOADS  
STATION 13 R.G.W. (72-1000# BOMBS) L.A.A. @ 5000'

PAGE 1  
REPORT NO. 2  
MODEL X

DISTANCE FROM L.E. % CHORD (L/M)	$\frac{P}{b}$ #/a	S.M.s	$(2 \times 3)$	MOMENT MULTIPLIER (4) x (5)
FIG. 6				

COMPOSITE INTERSPAR AIR LOADS

43.000 - 170	1	-170	8	-1360
39.125 - 181	4	-724	7	-5068
35.250 - 192	2	-384	6	-2304
31.375 - 203	4	-812	5	-4060
27.500 - 214	2	-428	4	-1712
23.625 - 225	4	-900	3	-2700
19.750 - 235	2	-470	2	-940
15.875 - 245	4	-980	1	-380
12.000 - 253	1	-253	0	0
$\Sigma$		-5121	-19124	

$$N_x = \frac{1.5bc}{144} \frac{0.38875(512)}{3} = -778 \#$$

DISTANCE FROM L.E. % CHORD (L/M)	$\frac{P}{b}$ #/a	S.M.s	$(2 \times 3)$	MOMENT MULTIPLIER (4) x (11)
FIG. 6				

LOWER SURFACE INTERSPAR AIR LOADS

43.000 - 58	1	-58	8	-464
39.125 - 66	4	-264	7	-1948
35.250 - 73	2	-146	6	-876
31.375 - 78	4	-312	5	-1560
27.500 - 75	2	-150	4	-600
23.625 - 66	4	-264	3	-792
19.750 - 52	2	-104	2	-208
15.875 - 35	4	-140	1	-140
12.000 - 15	1	-15	0	0
$\Sigma$		-1453	-6488	

$$N_y = \frac{1.5bc}{144} \frac{0.38875(-1453)}{3} = -2208 \#$$

$$M_x = \frac{1.5bc}{144} \frac{0.38875(-19124)}{3} = -349,945 \#$$

$$M_y = \frac{1.5bc}{144} \frac{0.38875(-6488)}{3} = -118,722 \#$$

$$X = -349,945 = 44.975" \text{ AFT F.S.}$$

$$X = \frac{-118,722}{2208} = 53.777" \text{ AFT F.S.}$$

NOTE: SIGNS (+ or -) FOLLOW THOSE USED FOR PRESSURE DISTRIBUTION AND HAVE NO CONSISTENT MEANING WITH RESPECT TO FORCES. THEREFORE, DIRECTION OF FORCES IS INDICATED BY ARROWS - NOT BY SIGNS.

\* FOR DEFINITION OF  
TERMS SEE P. 57

CALC. BY: *[Signature]*  
CHECKED BY: *[Signature]*

ANALYSIS WING  
PREPARED BY B. C. L. Fox  
CHECKED BY H. Heydorn  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. FZS-36-242  
MODEL XB3G  
DATE 11/47

CONDITION I - D.G.W. (265,192#) - L.A.A. @ 5000'  
BULKHEAD #13

AIR LOADS (INTERSPAR)

(REF. SKETCHES, P. 65)

REPLACING THE AIR LOADS WITH EQUIVALENT  
TRAPEZOIDS,

COMPOSITE INTERSPAR LOAD =  $N_{L.S.} = 8293 \text{#} \uparrow$   
C.G. AFT OF F.S. = 44.849" (REF. P.58)

$$W_{FC} = 103.50 \text{#/in}$$

$$W_{RC} = 68.83 \text{#/in}$$

UPPER SURFACE INTERSPAR LOAD =  $N_U = 10,460 \text{#} \uparrow$   
C.G. AFT OF F.S. = 46.200" (REF. P.58)

$$W_{FU} = 120.70 \text{#/in} \uparrow$$

$$W_{RU} = 96.55 \text{#/in} \uparrow$$

LOWER SURFACE INTERSPAR LOAD:

$$W_{FL} = W_{FC} - W_{FU} = 103.50 - 120.70 = -17.20 \text{#/in} \downarrow$$

$$W_{RL} = W_{RC} - W_{RU} = 68.83 - 96.55 = -27.72 \text{#/in} \downarrow$$

CRUSHING LOADS

CALCULATING THE CRUSHING LOAD,

$$M'_x = 83.45 \times 10^6 \text{ IN}^{\#} \text{ REF. FZS-36-240, P. 81.}$$

$$E = 10.3 \times 10^6$$

$$L = 36.375 \text{ IN. (BULKHEAD SPACING)}$$

$$I_x = 69,535 \text{ IN}^4 \text{ REF. FZS-36-141, P. 59}$$

$$\frac{I_x}{Q_x} = 61.3 \text{ IN} \text{ REF. FZS-36-141, P. 207}$$

$$\text{CRUSHING LOAD} = \frac{(M'_x)^2}{(\frac{I_x}{Q_x})EI} = \frac{(83.45 \times 10^6)^2 36.375}{61.3 \times 10^6 \times 69,535} = 5770 \text{#}$$

ANALYSIS WING  
PREPARED BY B. C. Johnson  
CHECKED BY H. L. Yancey  
REVISED BY

## Consolidated Vultee Aircraft Corporation

FORT WORTH DIVISION  
FORT WORTH, TEXASPAGE 64  
REPORT NO. FZS-36-242  
MODEL XB36  
DATE 11/47BULKHEAD #13 (DGN(265,192#) LAA@5000')

REPLACING THE CRUSHING LOAD WITH THE EQUIVALENT TRAPEZOID SUCH THAT  $\frac{H_R}{H_F} = \frac{W_R}{W_F}$  WHERE  $H_F$  = CONTOUR DEPTH OF FRONT SPAR.

$$H_R = 63.789", H_F = 49.353"$$

$$W_F = 52.29 \text{#/in} \quad (\text{REF. P. 11})$$

$$W_R = 67.61 \text{#/in}$$

FUEL LOAD

SINCE THE AIR LOADS OPERATE UPWARD, THE FUEL LOAD ACTS ON THE LOWER SURFACE

$$P_{FUEL} = 5418.7 \times 3.969 = -21507 \text{#} \downarrow$$

$$\frac{P_{FUEL}(XB36)}{*P_{FUEL}(B36)} = \frac{21507}{21703} = .991 \quad \begin{array}{l} \text{REF. LOAD - FZS-36-240, P. 52} \\ \text{INERTIA LOAD FACTOR -} \\ \text{FZS-36-126, P. 84} \end{array}$$

$$W_{FUEL}(XB36) = *199.385(.991) = 197.53 \text{#} \downarrow$$

$$W_{RFUEL}(XB36) = *251.610(.991) = 249.35 \text{#} \downarrow$$

$$X = 49.98" *$$

(REF. P. 65)

\* FUEL LOAD FOR B36A TAKEN FROM P. I-215  
FZS-36-142.

ANALYSIS WING  
PREPARED BY B. Clift  
CHECKED BY H. H. Jackson  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. FZS-36-2A2  
MODEL XB3G  
DATE 11/47

BULKHEAD # 13  
D.G.W. (265,192#) L.A.A. @ 5000'

COMBINED AIR (INTERSPAR),  
CRUSHING AND FUEL LOADS  
ACTING ON BULKHEAD.

UPPER SURFACE

F.S. ORDINATE =

$$W_{FU} + W_F = -68.41 \text{#/in}$$

R.S. ORDINATE =

$$W_{RU} + W_R = -28.94 \text{#/in}$$

LOWER SURFACE

F.S. ORDINATE =

$$W_{FL} + W_F + W_{FFUEL} = 162.50 \text{#/in}$$

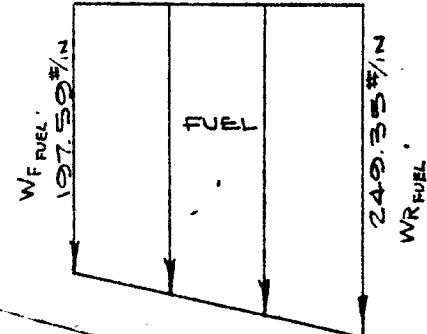
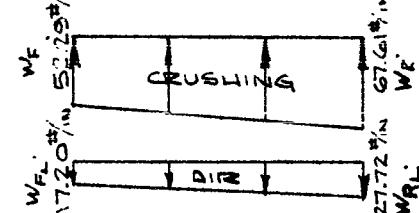
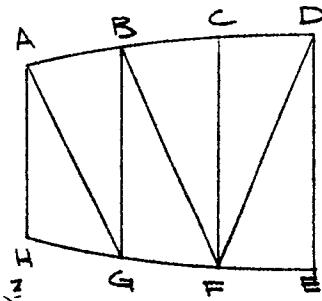
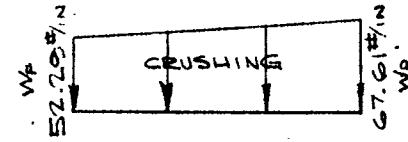
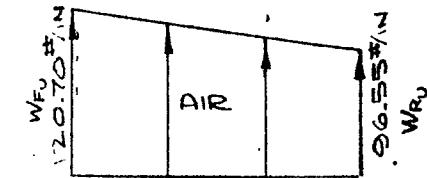
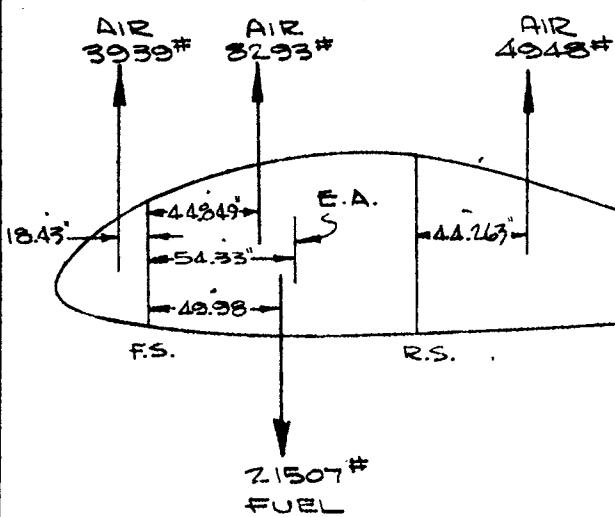
R.S. ORDINATE =

$$W_{RL} + W_R + W_{RFUEL} = 209.46 \text{#/in}$$

WING STA. # 13 FUEL AND

AIR LOADING

(SEE FIG. BELOW)



ANALYSIS WING  
PREPARED BY B. C. Clift  
CHECKED BY K. L. Clark  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

PAGE 66  
REPORT NO. FW 3-36-242  
MODEL XB3G  
DATE 11/47

BULKHEAD # 13  
D.G.W. (265,192#) - LAA @ 5000'

BREAKDOWN OF NET AIR, CRUSHING AND FUEL  
LOADS INTO PANEL POINT LOADS

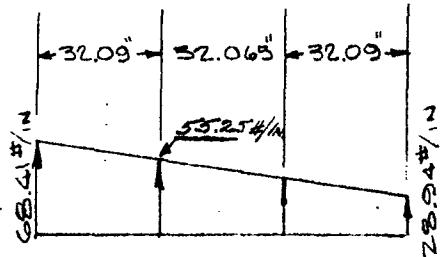
UPPER SURFACE

$$P_A = 1026 \text{ #}$$

$$P_B = 1776 \text{ #}$$

$$P_C = 1350 \text{ #}$$

$$P_D = 535 \text{ #}$$



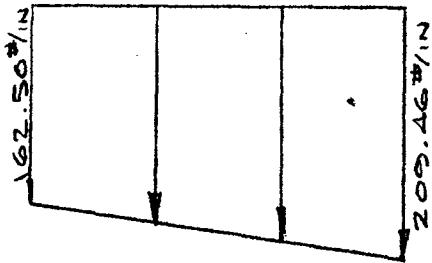
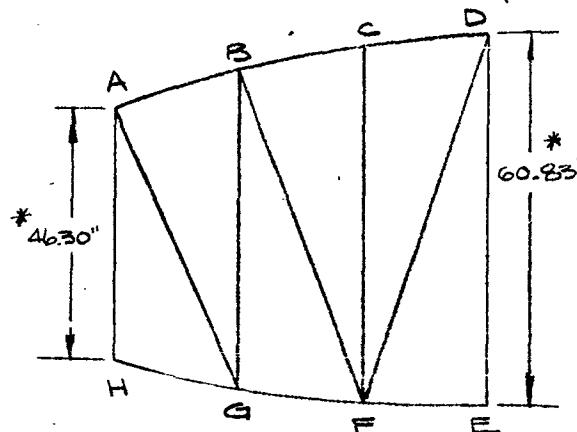
LOWER SURFACE

$$P_E = 282 \text{ #}$$

$$P_F = 6219 \text{ #}$$

$$P_G = 5714 \text{ #}$$

$$P_H = 2686 \text{ #}$$



COMBINED LOADS

COUPLE AT F.S. RESULTING FROM LEADING EDGE AIR LOAD

$$\frac{M_L}{*46.30} = \frac{72600}{46.30} = 1568 \text{ #} \quad (\text{REF. TABLE } \text{XVII P. 57})$$

COUPLE AT R.S. RESULTING FROM TRAILING EDGE AIR LOAD

$$\frac{M_T}{*60.83} = \frac{219014}{60.83} = 3600 \text{ #} \quad (\text{REF. TABLE } \text{XVII P. 57})$$

\* DEPTH OF SPAR BETWEEN TRUSS POINTS. SEE P. 69

ANALYSIS WING  
 PREPARED BY B. Clegg  
 CHECKED BY A. Myrick  
 REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
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 FORT WORTH, TEXAS

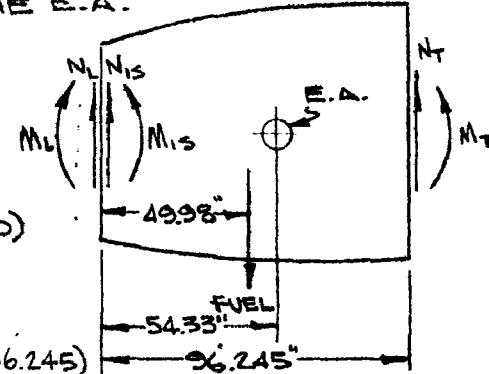
PAGE 67  
 REPORT NO. FWS-36-242  
 MODEL X53G  
 DATE 11/4/7

BULKHEAD #13  
D.G.W. (265,192#) LAA @ 5000'

REACTIONS ON BULKHEAD

TRANSFERRING ALL FORCES TO THE E.A.

$$\begin{aligned} V &= N_L + N_{IS} + N_T + P_{FUEL} \\ &= 3939 + 3293 + 4948 - 21507 \\ &= \underline{-4327\#} \end{aligned}$$



$$T_{BA} = M_L + M_{IS} + N_T (\bar{x}_{TE} + I.S. CHORD)$$

$$+ P_{FUEL} (\bar{x}_{FUEL}) + 54.33 V$$

$$= 72,600 - 371,936 - 4948(44.263 + 96.245)$$

$$+ 21507(49.98) + 54.33(-4327)$$

$$= \underline{154,740\#}$$

(REF. TAB. XVI)  
TAB. XVII

REACTIONS ON F.S. & R.S. DUE TO V

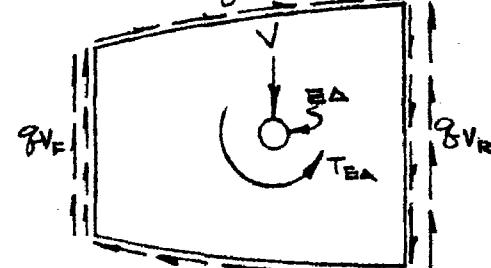
$$V_{FS} = \frac{41.915}{96.245} \times 4327 = 1884 \uparrow$$

E.A. LOCATION =  
 0.175C AFT OF F.S.  
 $= .175 \times 310.471 = 54.33"$

$$V_{RS} = V - V_{FS} = 4327 - 1884 = 2443 \uparrow$$

$$q_{V_{FS}} = \frac{1884}{46.30} = 40.691 \#/\text{in}$$

$$q_{V_{RS}} = \frac{2443}{60.83} = 40.161 \#/\text{in}$$



REACTIONS DUE TO T\_EA

$$q_\theta = \frac{T_{EA}}{2A} = \frac{154740}{11840} = \underline{13.069 \#/\text{in}}$$

(2A = 11840" REF. FWS-36-141, P. 206)

REACTING FORCES  
ON BULKHEAD

NET REACTIONS OF F.S. AND R.S.

$$q_{F.S.} = 40.691 + 13.069 = 53.760 \#/\text{in} \quad (2486\#)$$

$$q_{R.S.} = 40.161 - 13.069 = 27.092 \#/\text{in} \quad (1648\#)$$

\* DEPTH OF SPAR BETWEEN TRUSS POINTS, SEE FIG. 69

ANALYSIS WING  
PREPARED BY B. Clegg  
CHECKED BY B. Clegg  
REVISED BY

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FORT WORTH, TEXAS

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REPORT NO. FZS-3G-242  
MODEL XB3G  
DATE 11/47

BULKHEAD #13

D.G.W. (265,192#) LAA@ 5000'

CORRECTION LOADS

CORRECTING LOADS ON F.S. & R.S. TO ACCOUNT FOR  
THE TRANSFER OF THE SHEAR FLOW FROM THE CONTOURS  
TO THE CENTROIDS OF THE STRAIGHT LINE CHORD MEMBERS

UPPER SURFACE

$$T = 2A_U q_0^* = 2 \times 240.53 \times 13.069 = 6290''^*$$

$$R_{UFR} = \frac{6290}{96.245} = 65.35''^*$$

LOWER SURFACE

$$T = 2A_L q_0^* = 2 \times 107.82 \times 13.069 = 2815''^*$$

$$R_{LFR} = \frac{2815}{96.245} = 29.25''^*$$

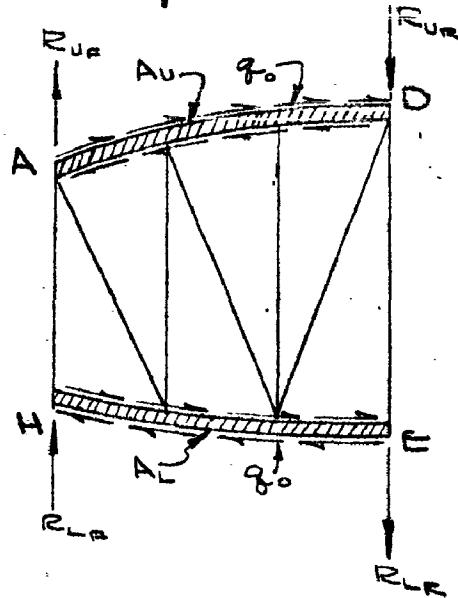
CORRECTED PANEL POINT  
LOADS AT F.S. AND R.S.

$$P_A = 1026 + R_{U_F} = 1091.35''^*$$

$$P_D = 535 - R_{U_R} = 469.65''^*$$

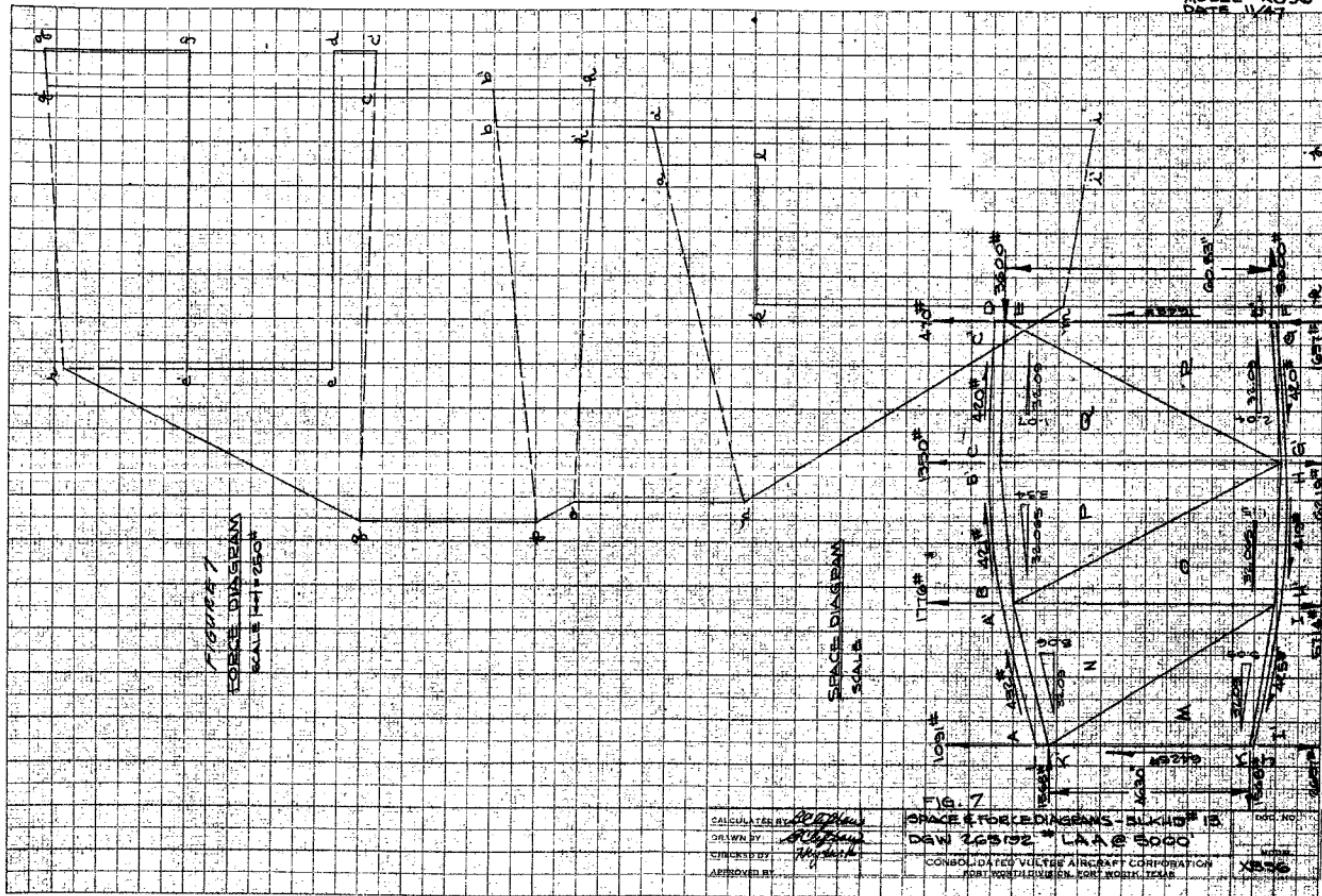
$$P_E = 3282 + R_{L_R} = 3311.25''^*$$

$$P_H = 2686 - R_{L_F} = 2656.75''^*$$



\* SEE PAGE 67 FOR  $q_0^*$ .

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REPORT NO F35-36-242  
MODEL X536  
DATE 1/17



ANALYSIS WING  
PREPARED BY *B. C. G.*  
CHECKED BY *H. Hydock*  
REVISED BY

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REPORT NO. FZS-36-242  
MODEL XB36  
DATE 11/47

CONDITION II - D.G.W. (265,192#) ILAA @ 5000'  
BULKHEAD #13

AIR LOADS (INTERSPAR) (REF. SKETCHES P. 72)

REPLACING THE AIR LOADS WITH EQUIVALENT TRAPEZOIDS,

$$\text{COMPOSITE INTERSPAR AIR LOAD} = N_{I.S.} = 4604 \#$$

C.G. AFT OF F.S. = 34.476" (REF. P. 60)

$$W_{F_C} = 88.50 \#/in$$

$$W_{R_C} = 7.25 \#/in$$

$$\text{LOWER SURFACE INTERSPAR AIR LOAD} = N_{L.S.} = -7866 \#$$

C.G. AFT OF F.S. = 44.005" (REF. P. 60)

$$W_{F_L} = 102.40 \#/in$$

$$W_{R_L} = 61.00 \#/in$$

UPPER SURFACE INTERSPAR AIR LOAD

$$W_{F_U} = W_{F_C} - W_{F_L} = 88.50 - 102.40 = -13.90 \#/in$$

$$W_{R_U} = W_{R_C} - W_{R_L} = 7.25 - 61.00 = -53.75 \#/in$$

CRUSHING LOADS

CALCULATING THE CRUSHING LOAD,

$$M'_x = -54.12 \times 10^6 \quad \text{REF. FZS-36-240, P. 97}$$

$$E = 10.3 \times 10^6$$

L = 36.375 in (BULKHEAD SPACING)

$$I_x = 69,535 \text{ in}^4 \quad \text{REF: FZS-36-141, P. 59}$$

$$I_y/Q_x = 61.3 \text{ in.} \quad \text{REF. FZS-36-141, P. 207}$$

$$\text{CRUSHING LOAD} = \frac{(M'_x)^2 L}{(I_x/Q_x)EI} = \frac{(-54.12 \times 10^6)^2 \times 36.375}{61.3 \times 10.3 \times 10^6 \times 69,535} \\ = 2427 \#$$

ANALYSIS WING  
PREPARED BY B. Cliftier  
CHECKED BY A. Myrda  
REVISED BY

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FORT WORTH, TEXAS

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MODEL XB36  
DATE 11/47

BULKHEAD # 13  
D.G.W. (265,192#) ILAA @ 5000'

CRUSHING LOADS (CONT'D)

REPLACING THE CRUSHING LOAD WITH THE EQUIVALENT TRAPEZOID SUCH THAT  $\frac{H_R}{H_F} = \frac{W_R}{W_F}$  WHERE  $H_F$  = CONTOUR DEPTH OF FRONT SPAR.

$$H_R = 63.789", H_F = 49.353"$$

$$W_F = 22.00 \text{#/in.}$$

$$W_R = 28.43 \text{#/in.} \quad (\text{REF. P. 72})$$

FUEL LOAD

SINCE THE AIR LOADS OPERATE DOWNWARD, THE FUEL LOAD ACTS ON THE UPPER SURFACE.

$$P_{FUEL} = 5418.7 \times 1.675 \times 1.5 = 13617 \text{#}$$

REF: LOAD-FZS-36-240, P.52

INERTIA LOAD FACTOR-

FZS-36-126, P. 84

USING RATIO OF FUEL LOADS, B-36A & XB36.

$$\frac{P_{FUEL}(XB36)}{* P_{FUEL}(B36A)} = \frac{13617}{* 13574.6} = 1.003$$

$$W_{FUEL} = * 124.713(1.003) = 125.09 \text{#/in.}$$

$$W_{RFUEL} = * 157.379(1.003) = 157.85 \text{#/in.}$$

(REF. P. 72)

\* FUEL LOAD FOR B36A TAKEN FROM P. I-222  
FZS-36-142.

ANALYSIS WING  
PREPARED BY B. Clegg  
CHECKED BY R. Rydmark  
REVISED BY

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REPORT NO. FZS-36-242  
MODEL XB-36  
DATE 11/47

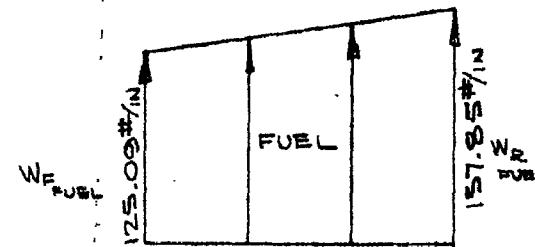
BULKHEAD #13  
D.G.W. (265,192#) ILAA@5000'

COMBINED AIR (INTERSPAR),  
CRUSHING AND FUEL LOADS  
ACTING ON BULKHEAD.

UPPER SURFACE

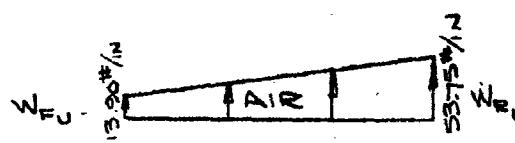
F.S. ORDINATE =

$$W_{FU} + W_F + W_{F_{FUEL}} = 116.99 \text{#/in}$$



R.S. ORDINATE =

$$W_{RU} + W_R + W_{RF_{FUEL}} = 183.17 \text{#/in}$$



LOWER SURFACE

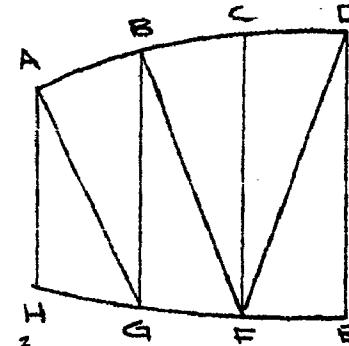
F.S. ORDINATE =

$$W_{FL} + W_F = 80.40 \text{#/in}$$



R.S. ORDINATE =

$$W_{RL} + W_R = 32.57 \text{#/in}$$



BREAK DOWN OF NET AIR, CRUSHING  
AND FUEL LOADS INTO PANEL  
POINT LOADS:

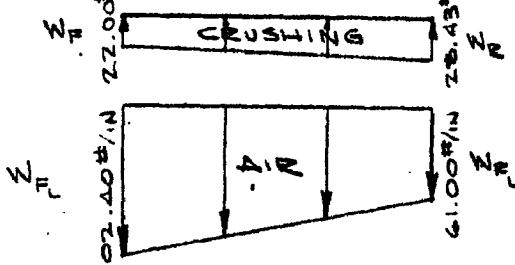
UPPER SURFACE

$$P_A = 1994 \text{#}$$

$$P_B = 4459 \text{#}$$

$$P_C = 5168 \text{#}$$

$$P_D = 2824 \text{#}$$



ANALYSIS WING  
PREPARED BY *B.C. Lippincott*  
CHECKED BY *H. Heydweiler*  
REVISED BY

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FORT WORTH, TEXAS

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REPORT NO. FZS-36-242  
MODEL X-336  
DATE 1/47

BULKHEAD #13  
D.G.W. (265,192#) ILDA @ 5000'

BREAKDOWN OF NET AIR, CRUSHING,  
AND FUEL LOADS INTO PANEL  
POINT LOADS, (CONT'D)

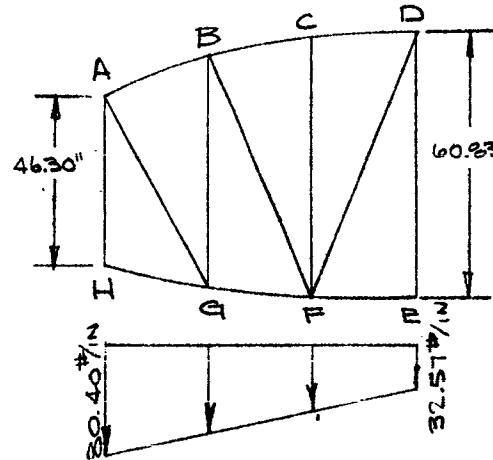
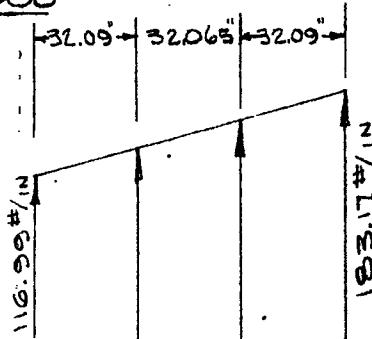
LOWER SURFACE

$$P_E = 606\#$$

$$P_F = 1559\#$$

$$P_G = 2069\#$$

$$P_H = 1205\#$$



COMBINED LOADS

COUPLE AT F.S. RESULTING FROM LEADING EDGE AIR LOAD

$$\frac{M_L}{46.30} = \frac{101,192}{46.30} = 2185\# \quad (\text{REF: TABLE } XVIII \text{ P.59})$$

COUPLE AT R.S. RESULTING FROM TRAILING EDGE AIR LOAD

$$\frac{M_T}{60.83} = \frac{22111}{60.83} = 364\# \quad (\text{REF: TABLE } XVIII \text{ P.59})$$

\* DEPTH OF SPAR BETWEEN TRUSS POINTS. SEE P. 77

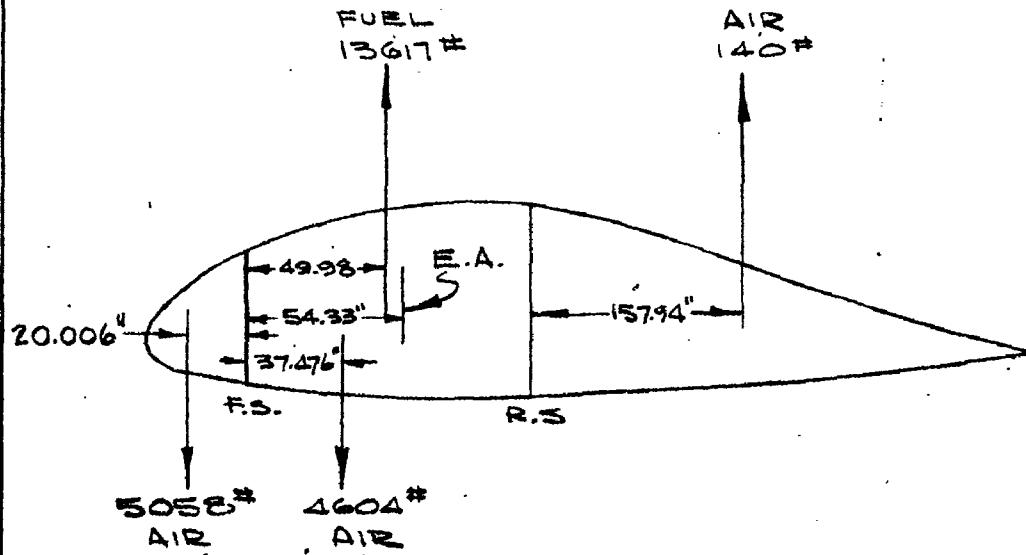
ANALYSIS WING  
PREPARED BY B.C. G.  
CHECKED BY Hayward  
REVISED BY

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FORT WORTH, TEXAS

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REPORT NO. F25-36-242  
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DATE 11/47

BULKHEAD #13  
D.G.W. (265,192#) ILAA@5000'

WING STATION #13 FUEL AND AIR LOADING

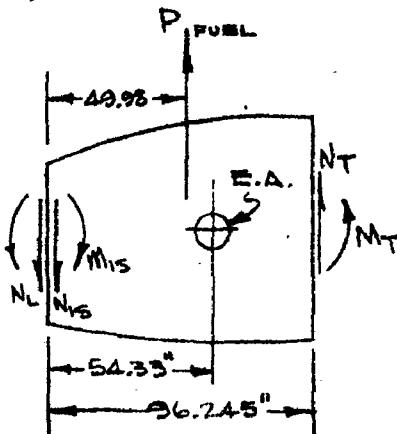


REACTIONS ON BULKHEAD

TRANSFERRING ALL FORCES  
TO E.A.

$$\begin{aligned}V &= N_L + N_{IS} + N_T + P_{FUEL} \\&= 5058 + 4604 - 140 - 13617 \quad M_L \\&= \underline{\underline{4095\#}}\end{aligned}$$

REF: TABLE XIII P. 59  
TABLE XII P. 60



$$\begin{aligned}T_{E.A.} &= M_L + M_{IS_{FS}} + N_T (\bar{x}_{TE} + I.S. CHORD) \\&\quad + P_{FUEL} (\bar{x}_{FUEL}) + 54.33 V \\&= -101,192 + 158719 - 140(157.94 + 96.245) \\&\quad - 13617(49.98) + 54.33(4095) \\&= \underline{\underline{-436,156\#}}$$

ANALYSIS WING  
PREPARED BY B. Clift  
CHECKED BY W. J. D.  
REVISED BY

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FORT WORTH, TEXAS

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MODEL XB36  
DATE 11/47

BULKHEAD #13  
D.G.W. (265,192#) ILAA @ 5000#

REACTIONS ON BULKHEAD (CONT'D)

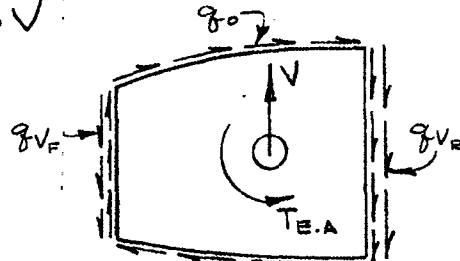
REACTIONS ON F.S. & R.S. DUE TO V

$$V_{FS} = \frac{41.915}{96.245} \times 4095 = 1784 \#$$

$$V_{RS} = 4095 - 1784 = 2311 \#$$

$$qV_F = \frac{1784}{46.30} = 38.53 \#/in$$

$$qV_R = \frac{2311}{60.83} = 37.99 \#/in$$



REACTING FORCES  
ON BULKHEAD

E.A. LOCATION =  
0.175 C AFT F.S.  
= .175 x 310.471 = 54.33"

REACTIONS DUE TO T.B.A.

$$q_o = \frac{T_B.A.}{2A} \frac{436.156}{11840} = 36.84 \#/in$$

(2A = 11840 in REF: FES-36-141, P. 206)

NET REACTIONS OF F.S. AND R.S.

$$q_{F.S.} = -38.53 + 36.84 = -1.69 \#/in \quad (78.25\#)$$

$$q_{R.S.} = -37.99 - 36.84 = -74.83 \#/in \quad (4552\#)$$

CORRECTION LOADS

CORRECTING LOADS ON F.S. & R.S. TO ACCOUNT FOR  
THE TRANSFER OF THE SHEAR FLOW FROM THE CONTOURS  
TO THE CENTROIDS OF THE STRAIGHT LINE CHORD MEMBER

UPPER SURFACE

$$T = 2A_0 q_s = 2 \times 240.53 \times 36.84 = 17,722 \#$$

$$R_{U.F.R} = \frac{17722}{96.245} = 184.1 \#$$

\* DEPTH OF SPAR BETWEEN TRUSS POINTS, SEE P. 69

ANALYSIS WING  
PREPARED BY 36047  
CHECKED BY H. J. DICK  
REVISED BY

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FORT WORTH, TEXAS

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BULKHEAD #13  
D.G.W. (265,192#) ILAA @ 5000'

CORRECTION LOADS (CONT'D)

LOWER SURFACE

$$T = 2A_L g_0 = 2 \times 107.82 \times 36.84 = 7944 \text{ "#}$$

$$R_{LFR} = \frac{7944}{96.245} = 82.54 \text{ "#}$$

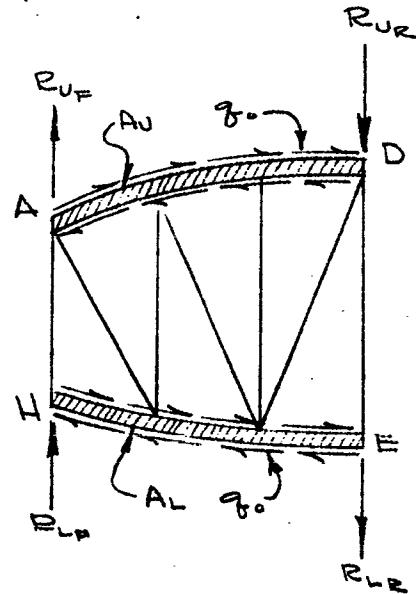
CORRECTED PANEL POINT  
LOADS AT F.S. AND R.S.

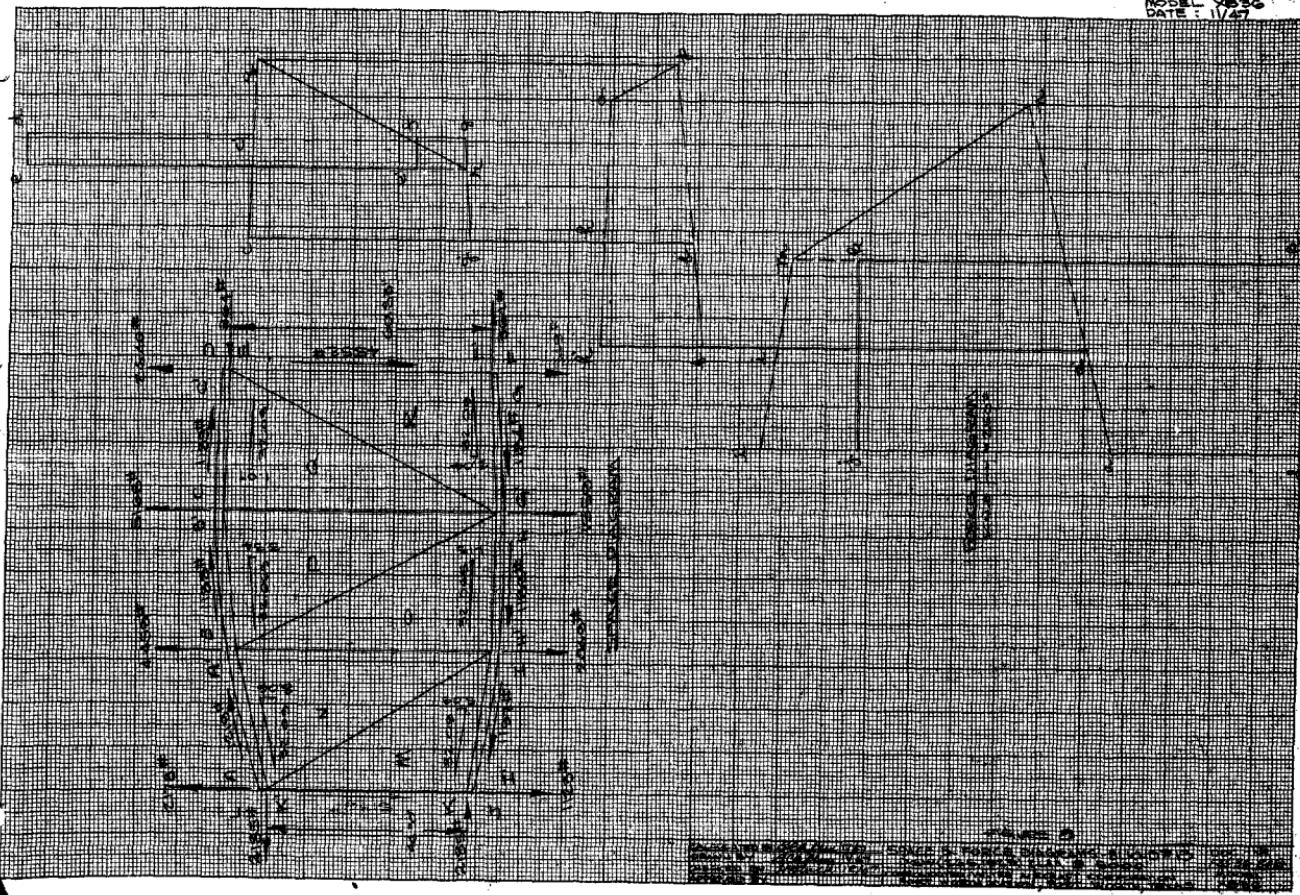
$$P_A = 1994 + 184 = 2178 \text{ "#}$$

$$P_D = 2824 - 184 = 2640 \text{ "#}$$

$$P_E = 606 + 82.5 = 688.5 \text{ "#}$$

$$P_H = 1205 - 82.5 = 1122.5 \text{ "#}$$





ANALYSIS WING  
PREPARED BY B. Clegg Jr.  
CHECKED BY Voss  
REVISED BY \_\_\_\_\_

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CONDITION III - R.G.W. (72-1000# BOMBS) LAA @ 5000'  
BULKHEAD #13

AIR LOADS (INTERSPAR) (REF. SKETCHES P. 81.)

REPLACING THE AIR LOADS WITH EQUIVALENT TRAPEZOIDS,

COMPOSITE INTERSPAR AIR LOAD =  $N_{IS} = 7781^{\#}$   
C.G. AFT OF F.S. = 44.975" (REF. P. 62)

$W_{FC} = 96.59^{\#/in}$

$W_{RC} = 65.10^{\#/in}$

LOWER SURFACE INTERSPAR AIR LOAD =  $N_{LS} = 2208^{\#}$   
C.G. AFT OF F.S. = 53.777" (REF. P. 62)

$W_{FL} = 14.97^{\#/in}$

$W_{RL} = 30.92^{\#/in}$

UPPER SURFACE INTERSPAR AIR LOAD

$W_{FU} = W_{FC} - W_{FL} = 96.59 + 14.97 = 111.56^{\#/in}$

$W_{RU} = W_{RC} - W_{RL} = 65.10 + 30.92 = 96.02^{\#/in}$

CRUSHING LOADS

CALCULATING THE CRUSHING LOAD

$M_x' = 79.6 \times 10^6$  REF: FZS-36-240, P. 153

$E = 10.3 \times 10^6$

$L = 36.375 \text{ in}$  (BULKHEAD SPACING)

$I_x = 69.535 \text{ in}^4$  REF: FZS-36-141, P. 59

$I_x/Q_x = 61.3 \text{ in}$  REF: FZS-36-141, P. 207

$$\text{CRUSHING LOAD} = \frac{(M_x')^2 L}{(I_x/Q_x) EI} = \frac{(79.6 \times 10^6)^2 \times 36.375}{61.3 \times 10.3 \times 10^6 \times 69.535} \\ = 5250^{\#}$$

ANALYSIS

WING

PREPARED BY

Baertzen

CHECKED BY

SOAR

REVISED BY

Consolidated Vultee Aircraft Corporation

FORT WORTH DIVISION

FORT WORTH, TEXAS

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REPORT NO. F25-36-242

MODEL

79

XB36

DATE

11/47

BULKHEAD #13R.G.W. (72-1000# BOMBS) LAA @ 5000'CRUSHING LOADS (CONT'D)

REPLACING THE CRUSHING LOAD WITH THE EQUIVALENT TRAPEZOID SUCH THAT  $\frac{H_R}{H_F} = \frac{W_R}{W_F}$  WHERE  $H_F$  = CONTOUR DEPTH OF F.S.

$$H_R = 63.789", H_F = 49.353"$$

$$W_F = 47.58 \text{#/in.} \quad (\text{REF. FIG. BELOW})$$

$$W_R = 61.51 \text{#/in.}$$

COMBINED AIR (INTERSPAR)  
AND CRUSHING LOADS ON  
BULKHEAD.

## UPPER SURFACE

F.S. ORDINATE =

$$W_{FU} + W_F = 63.98 \text{#/in}$$

R.S. ORDINATE =

$$W_{RU} + W_R = 34.51 \text{#/in}$$

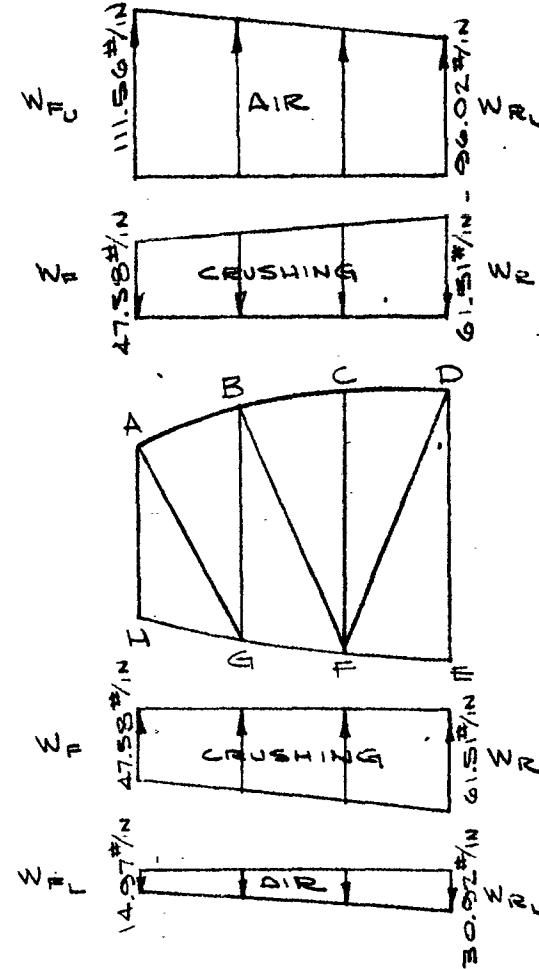
## LOWER SURFACE

F.S. ORDINATE =

$$W_{FL} + W_F = 32.61 \text{#/in}$$

R.S. ORDINATE =

$$W_{RL} + W_R = 30.59 \text{#/in}$$



ANALYSIS WING  
PREPARED BY B.C. Dyer  
CHECKED BY W.O.L.  
REVISED BY \_\_\_\_\_

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FORT WORTH DIVISION  
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DATE 11/47

BULKHEAD #13  
E.G.W. (72-1000# BOMBS) LAA@5000'

BREAKDOWN OF NET AIR AND CRUSHING LOADS  
INTO PANEL POINT LOADS

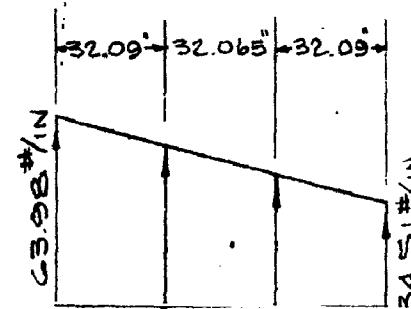
UPPER SURFACE

$$P_A = 974 \text{ #}$$

$$P_B = 1737 \text{ #}$$

$$P_C = 1422 \text{ #}$$

$$P_D = 606 \text{ #}$$



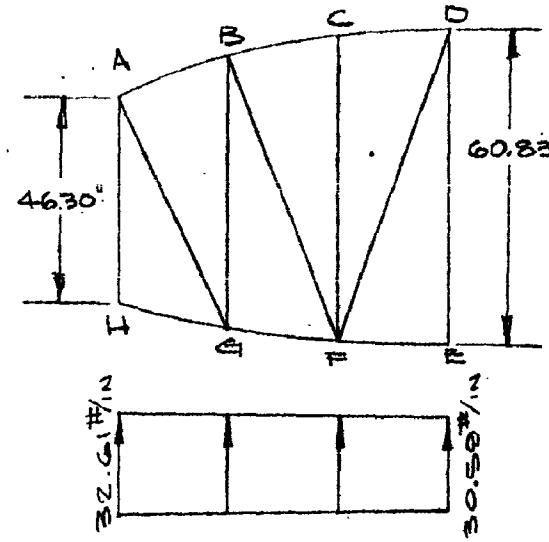
LOWER SURFACE

$$P_E = 494 \text{ #}$$

$$P_F = 1004 \text{ #}$$

$$P_G = 1023 \text{ #}$$

$$P_H = 521 \text{ #}$$



COUPLE AT FRONT SPAR RESULTING FROM L.E. AIR LOAD

$$\frac{M_L}{46.30} = \frac{66396}{46.30} = 1434 \text{ #} \quad (\text{REF: TAB. XX P. 61})$$

COUPLE AT REAR SPAR RESULTING FROM T.E. AIR LOAD

$$\frac{M_T}{60.83} = \frac{210824}{60.83} = 3466 \text{ #} \quad (\text{REF: TAB. XX P. 61})$$

\* DEPTH OF SPAR BETWEEN TRUSS POINTS, SEE P. 84

ANALYSIS WING  
PREPARED BY S. C. L. C.  
CHECKED BY NOM  
REVISED BY \_\_\_\_\_

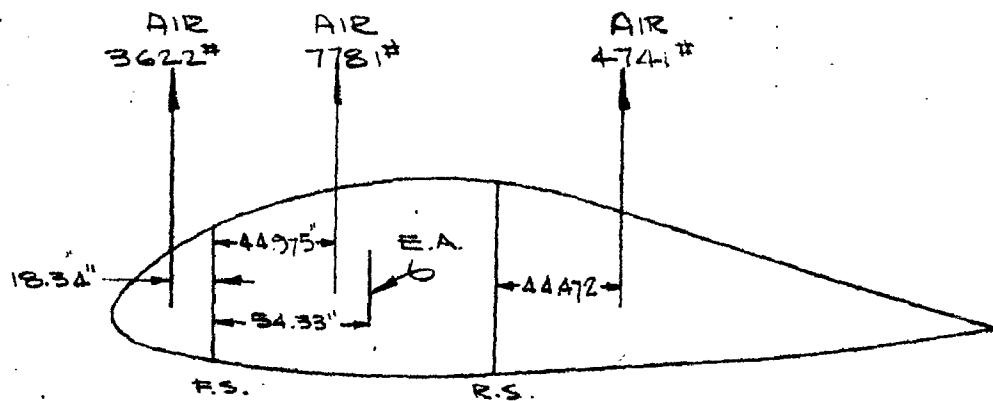
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FORT WORTH, TEXAS

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BULKHEAD #13  
R.G.W. (72-1000# BOMBS) LAA@5000'

WING STATION #13 AIR LOADING



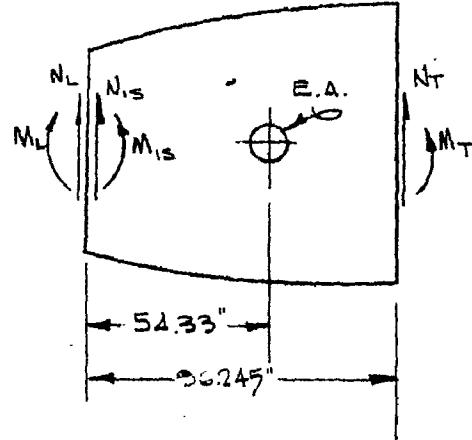
REACTIONS ON BULKHEAD

TRANSFERRING ALL FORCES TO E.A.

$$\begin{aligned}V &= N_L + N_{IS} + N_T \\&= 3622 + 7781 + 4741 \\&= \underline{16,144\#}\end{aligned}$$

REF: TABLE XX P. 61  
TABLE XXX P. 62

$$\begin{aligned}E.A. LOCATION &= \\0.175 &\text{ C.A.F. F.S.} \\&= .175 \times 310.471 = 54.33"\end{aligned}$$



$$\begin{aligned}T_{EA} &= M_L + M_{IS_{FS}} + N_T (X_{TE} + I.S. CHORD) + 54.33 V \\&= 66,396 - 349,945 - 4741(44.472 + 96.245) + 54.33(16,144) \\&= \underline{73,584\#}\end{aligned}$$

ANALYSIS WING  
PREPARED BY G. Clegg  
CHECKED BY Noss  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. FZS-36-242  
MODEL XBBG  
DATE 11/47

BULKHEAD #13  
R.G.W. (72-1000# BOMBS) LAA@5000'

REACTIONS ON BULKHEAD (CONT'D.)

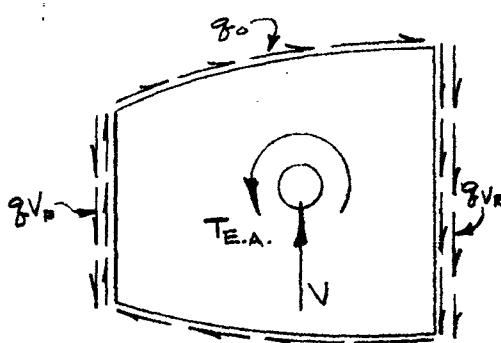
REACTIONS ON F.S. & R.S. DUE TO  $\nabla$

$$V_{FS} = \frac{41.915}{96.245} \times 16144 = 7031\#$$

$$V_{RS} = 16144 - 7031 = 9113\#$$

$$q_{V_F} = \frac{7031}{46.30} = 151.87\#/in$$

$$q_{V_R} = \frac{9113}{60.83} = 149.81\#/in$$



REACTIONS DUE TO T.E.A.

$$q_T = \frac{T_{EA}}{2A} = \frac{73584}{11840} = 6.21\#/in$$

( $2A = 11840$ " REF: FZS-36-141, P. 206)

NET REACTIONS OF F.S. & R.S.

$$q_{F.S.} = 151.87 - 6.21 = 145.66\#/in \quad (6744\#)$$

$$q_{R.S.} = 149.81 + 6.21 = 156.02\#/in \quad (9491\#)$$

CORRECTION LOADS

CORRECTING LOADS ON F.S. & R.S. TO ACCOUNT FOR THE TRANSFER OF THE SHEAR FLOW FROM THE CONTOURS TO THE CENTROIDS OF THE STRAIGHT LINE CHORD MEMBER.

UPPER SURFACE

$$T = 2 \Delta_U q_T^f = 2 \times 240.53 \times 6.21 = 2987\#$$

$$R_{U_F \& R} = \frac{2987}{96.245} = 31\#$$

F SEE P. 82 FOR  $q_T$ .

\* DEPTH OF SPAN BETWEEN TRUSS POINTS, SEE P. 84

ANALYSIS WING

PREPARED BY B. Cliftson

CHECKED BY YOL

REVISED BY \_\_\_\_\_

# Consolidated Vultee Aircraft Corporation

FORT WORTH DIVISION

FORT WORTH, TEXAS

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REPORT NO. FZS-36-2A2

MODEL XB3G

DATE 1/47

## BULKHEAD # 13

R.G.W. (72-1000# BOMBS) LAA @ 5000'

### CORRECTED LOADS (CONT'D)

#### LOWER SURFACE

$$T = 2 \Delta_L q_0 = 2 \times 107.82 \times 6.21 = 1339 \text{ "#}$$

$$R_{L-F\&R} = \frac{1339}{96.245} = 14 \text{ "#}$$

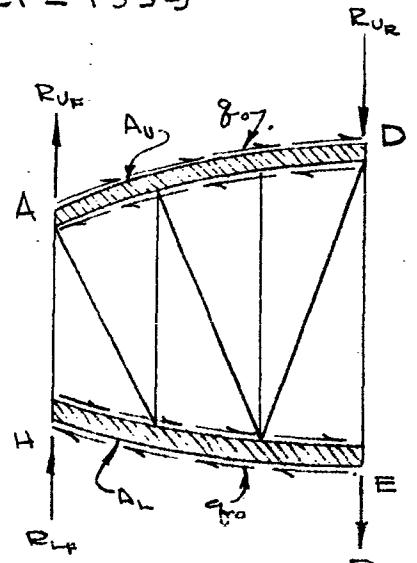
#### CORRECTED PANEL POINT LOADS AT F.S. AND R.S.

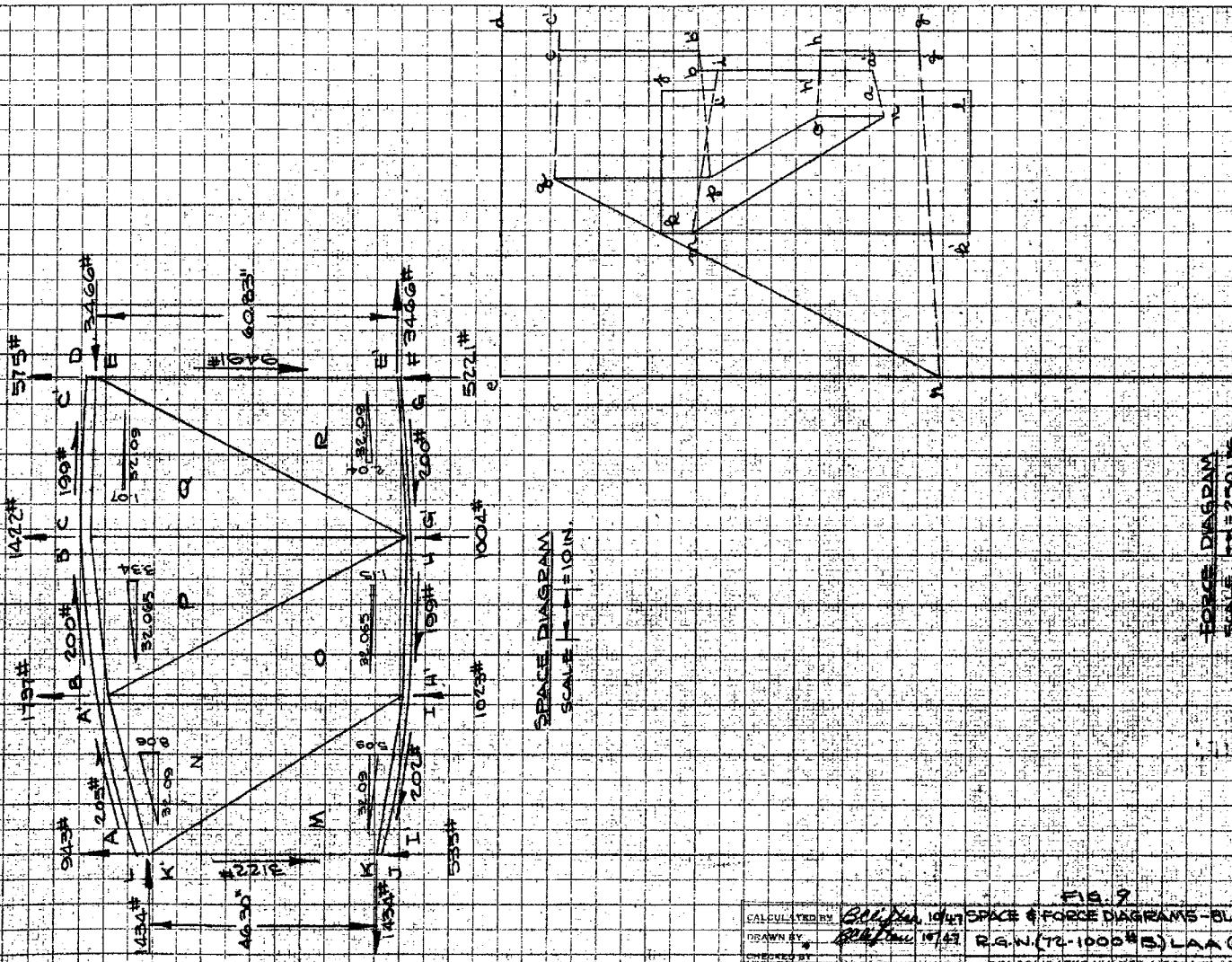
$$P_A = 974 + 31 = 943 \text{ "#}$$

$$P_D = 606 - 31 = 575 \text{ "#}$$

$$P_B = 494 - 14 = 480 \text{ "#}$$

$$P_H = 521 + 14 = 535 \text{ "#}$$





**CALCULATED BY** *Bellanca* 10/17 **SPACE & FORCE DIAGRAMS - BULLDOGS**  
**DRAWN BY** *Bellanca* 10/17 **R.G.N. (T2-1000-5) LAA @ 5000**  
**CHECKED BY**  **CONSOLIDATED VULTREY AIRCRAFT CORPORATION**  
**APPROVED BY**  **FORT WORTH DIVISION, FORT WORTH, TEXAS**

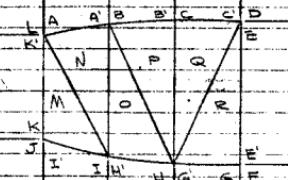
DOC NO.  
P25-~~90~~-~~42~~  
MODEL  
X8350

TABLE XII  
SUMMARY OF AXIAL LOADS  
IN TRUSS MEMBERS & COMPARISON X836 & Y836  
BULKHEAD #13

REPORT NO. 55-242  
MODEL X836  
DATE 1/17/57

FW 831 125 PADS 11-43

MEMBER	CONDITION	MAXIMUM LOAD		MAXIMUM LOAD	
		TEN.	COMP.	TEN.	COMP.
D.G.W.	D.G.W. R.G.W. L.A.A. L.A.A. 1.L.A.A. 75-10000 G5000 25000 15000	X836	Y836	P 1.25	
FIG 7	FIG 8 FIG 7	+4150	-3926	+3940	-4300
AN	+3368 +4130 -270	+2911	-4360	+3900	-4383
AN	+4360 +2911 -473	+3270	-4483	+3240	-4620
BP	+4482 +3270 -1075	+2082	-4910	+2240	-4700
BP	+4910 +2082 -1275	+2030	-4900	+2240	-4700
CQ	+1209 +2050 -1285	+867	-5320	+1220	-4780
CQ	+53.0 +867 -1484	+5140	-3260	+4420	-3200
ER	-3060 +5140 +4450	+588	-5041	3210	-3350
ER	+2412 +588 -5041	+3610	.	3150	-445
GR	+3610 +2665 +3480	+3280	-819	3070	-1240
GR	+3190 -819 +3280	+4660	-1640 +660	+4640	-1640 4335 -1795
HO	+4241 -2822 +461	+4241	-2822	+2500	-2810
IM	+2040 -1030 +1650	+2040	-1030	2000	-1120
IM	+16.5 -2227 +1448	+1615	-2227	1215	-2220
KM	+2930 +770 -325	+2930	-325	2600	-520
KM	-7495 +5906 +2797	+5906	-3495	5575	-3000
MN	+4472 -3255 -2270	+4270	-3255	4300	-3040
NO	+1250 +4860 +680	+4860	.	4300	-370
OP	+500 -815 +1250	+1250	-875	1280	-920
PQ	+2025 +4900 +1580	+4900	.	4145	-
QR	+3730 -2740 -4400	+3730	-4400	3620	-3640



CALC. BY *A.C. Green*  
CHKD. BY *E. C. Green*

ANALYSIS WING  
PREPARED BY B. Chappell  
CHECKED BY M. J. Ford  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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MODEL XB36  
DATE 12/47

BULKHEAD # 13

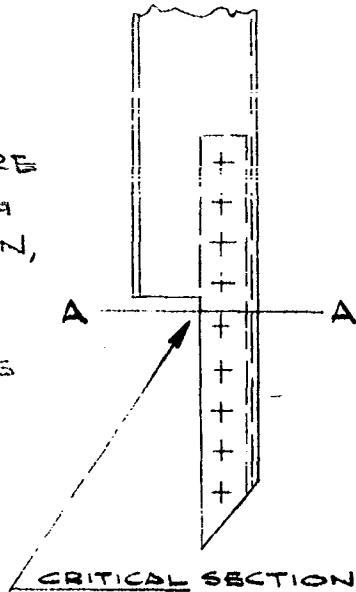
DETAIL ANALYSIS OF:

TUBULAR MEMBERS IN COMPRESSION AND TENSION

TUBE END ATTACHMENTS AND CHORD MEMBERS.

THE CRITICAL SECTION OF ALL TUBES WHEN LOADED IN TENSION IS AT THE JUNCTURE OF THE REDUCED END SECTION AND THE FULL CROSS SECTION AS SHOWN IN THE ACCOMPANYING SKETCH.

A COMPARISON WAS MADE OF THE TRUSS MEMBERS AND THEIR AXIAL LOADS FOR THE YB36 & THE XB36. FROM THIS COMPARISON & A STUDY OF THE YB36 ANALYSIS (FZS-36-142 P.I. 237), IT WAS FOUND THAT THE UPPER ENDS OF TUBES NO & PQ WERE CRITICAL IN COMBINED BENDING & TENSION IN THE END SECTION, & FOR THE RIVET ATTACHMENT TO THE CHORD MEMBER. THE ANALYSES OF THESE JOINTS ARE, THEREFORE, MADE.



## CONSOLIDATED VULTEE AIRCRAFT CORPORATION TABLE XXII.

PORT WORTH DIVISION PORT WORTH, TEXAS

FW 331 125 PAGE 11-43

TUBULAR MEMBERS IN COMPRESSION & TENSION  
STATION #13PAGE 87  
REPORT FEB. 26, 1942  
MODEL 1870

MEMBER	MAX. COMP. LOAD #	TUBE NUMBER	SIZE OF TUBE	AREA OF TUBE O"	SC #1/16"	* L	$P =$ $\frac{F_c P}{Y_f A}$	$\frac{1}{4} C P$	$F_c$	M.S. <sub>c</sub>	MAX. TENS. LOAD ft. <sup>2</sup>	$F_c$	M.S. <sub>t</sub>	DATE 1/4/42	
						(C) 5		1/3	(7) 6						
MN	3255	36W113-53	1.5" x 1.75" x .040	.2895	11.240	53	.1519	.7244	73.2	16,100	+.43	4270	14,750	49,000	+2.32
NO	—	36W113-37449	1.5" x 1.5" x .040	.2695	—	55	.1050	.6330	86.0	11,450	—	4860	18,050	—	+1.72
OP	-675	36W113-54	1.5" x 1.5" x .037	.2149	4070	62	.0846	.6274	98.3	6,900	+.69	1250	5,810	—	+7.43
PR	—	36W113-414-49	1.5" x 2.0" x .040	.3095	—	59	.2049	.8137	72.5	16,600	—	4900	13,830	—	+2.09
QR	-4400	36W113-55	2.0" x 2.0" x .051	.4733	0,300	62.5	.3453	.8541	73.2	16,100	+.73	3790	8,010	49,000	+5.11

NOTE: \* DISTANCE BETWEEN C.G.'S OF ATTACHING RIVETS  
FOR ALLOWABLE STRESSES, REFER TO PAGE I-G2, FRS-36-142.

CALC BY: [Signature]  
CHKD BY: [Signature]

ANALYSIS WING  
PREPARED BY B. Clegg  
CHECKED BY Heydrick  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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MODEL XB36  
DATE 12/47

BULKHEAD #13

TUBE "NO" IN TENSION (AND RIVET ATTACHMENT)

SINCE THE TUBE, END CHANNELS AND RIVETS ARE THE SAME FOR BOTH THE YB36 AND XB36, THE RATIO OF THE AXIAL LOADS IN THE MEMBER IS USED TO DETERMINE THE M.S. FOR THE XB36

$$\text{LOAD IN YB36} = 4300 \text{#} \quad (\text{P. I-240, FZS-36-142})$$

$$\text{LOAD IN XB36} = 4860 \text{#} \quad (\text{P. 85, TABLE XVII})$$

$$\text{M.S.}_t \text{ (YB36)} = +.32 \quad (\text{P. I-240, FZS-36-142})$$

$$\text{M.S.}_t \text{ (XB36)} = (+.32 + 1) \left( \frac{4300}{4860} \right) - 1 = \quad | +.17$$

RIVETED ATTACHMENT

$$\text{M.S. RIVETS (YB36)} = +.20 \quad (\text{P. I-240, FZS-36-142})$$

$$\text{M.S. RIVETS (XB36)} = (+.20 + 1) \left( \frac{4300}{4860} \right) - 1 = \quad | +.06$$

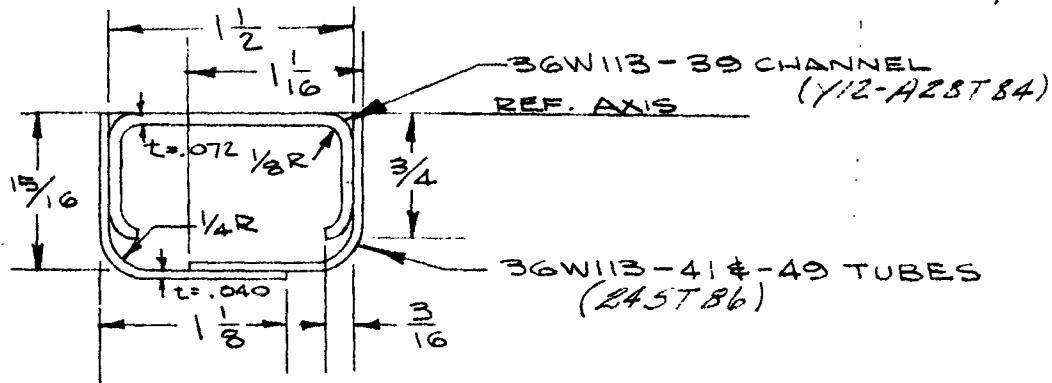
ANALYSIS WING  
PREPARED BY B. J. F.  
CHECKED BY H. L. W.  
REVISED BY

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FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. FZS-36-242  
MODEL XB36  
DATE 12/47

BULKHEAD #13

ANALYSIS OF TUBE "PQ" AND RIVET ATTACHMENT  
IN TENSION



CRITICAL SECTION

$$\bar{y} = .4512" \quad A = .3616 \text{ in}^2$$

$$y_t = .4512" \quad e = .4512"$$

$$y_c = .5263"$$

$$I = .04691 \text{ in}^4$$

THE MAXIMUM LOAD IS 4900# TENSION (D. 3)

$$f_t = \frac{P}{A} + \frac{Pe y_t}{I} = \frac{4900}{.3616} + \frac{4900 \times .4512 \times .4512}{.04691}$$

$$= 13,550 + 21,270 = 34,820 \text{#/in}^2$$

$$f_c = \frac{P}{A} - \frac{Pe y_c}{I} = 13,550 - \frac{4900 \times .4512 \times .5263}{.04691}$$

$$= 13,550 - 24,800 = -11,250 \text{#/in}^2$$

CONSERVATIVELY ASSUMING A COMBINED CONCENTRATION  
RIVET FACTOR  $R \times C_R = 0.70$

$$F_{t,u} = 70,000 \text{#/in}^2 \text{ (STRUCTURES BULLETIN B-1)}$$

$$M.S. = \frac{0.70 \times 70,000}{34820} - 1 = +.41$$

ANALYSIS WING  
PREPARED BY B. Clifton  
CHECKED BY M. J. Younkin  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

PAGE 90  
REPORT NO. FZS-36-242  
MODEL XB36  
DATE 12/17

BULKHEAD #13

ANALYSIS OF TUBE "PQ" (CONT'D)

RIVETED ATTACHMENT

THE ATTACHMENT OF THE CHANNEL INSERT 36W113-39 TO THE UPPER CHORD MEMBER IS CRITICAL. THE (6) RIVETS (Q4305-DB) ARE CRITICAL IN SHEAR.

ALLOWABLE SINGLE SHEAR = 1764#  
(STRUCTURES BULLETIN B-6)

$$M.S. \text{ RIVETS} = \frac{6 \times 1764}{4900} - 1 = +1.16$$

CHORD MEMBERS

THE XB36 CHORD MEMBERS FOR THIS BULKHEAD ARE THE SAME AS THOSE OF THE YB36; THEREFORE A REASONABLY CLOSE CHECK CAN BE MADE OF THE XB36 THROUGH A COMPARISON OF THE APPLIED LOADS ON THE CHORD MEMBERS. THIS TYPE OF CHECK IS FURTHER JUSTIFIED BY THE VERY HIGH M.S. FOUND IN THE YB36 ANALYSIS. FROM A STUDY OF THE DESIGN CONDITIONS, IT IS FOUND THAT THE XB36 AND YB36 CHORD MEMBERS ARE CRITICAL FOR THE SAME CONDITIONS. THE CRITICAL POINTS USED IN THE YB36 ANALYSIS ARE USED HERE FOR THE XB36 FOR A COMPLETE EXPLANATION OF THE CHORD MEMBER ANALYSIS PROCEDURE SEE REPORT FZS-36-142 (PAGES I-241 THRU I-256).

ANALYSIS WING  
PREPARED BY B. Clegg  
CHECKED BY H. Hyndick  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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MODEL XB36  
DATE 12/47

## BULK HEAD #13

### CHORD MEMBERS (CONT'D)

#### UPPER CHORD MEMBER (ABCD) (36W113-7)

THE UPPER CHORD MEMBER IS CRITICAL FOR TWO CONDITIONS. FOR CONDITION I, DGW-LAA@5000', THE CRITICAL COM-  
PRESSIVE STRESS OCCURS IN THE SKIN AT THE FIRST PANEL POINT AND FOR CONDITION II, DGW- ILAA@ 5000', THE CRITICAL STRESS OCCURS IN THE LIPPED FLANGE 13 IN. FORWARD OF THE REAR SPAR.

#### CONDITION I (DGW-LAA @ 5000')

AXIAL LOAD,  $P_1 = -4489 \text{#}$  (P. 85) COMP.

THE BENDING MOMENT,  $M$ , IS OBTAINED BY THE COMPARISON OF THE ORDINATES (AT THE CRITICAL POINT) OF THE NET LOAD DISTRIBUTION TRAPEZOIDS OF THE TWO MODELS.

$$\text{BORDINATE (YB36)} = 38.106 \text{#/in.} *$$

$$\text{BORDINATE (XB36)} = 55.25 \text{#/in.} (\text{P. 66})$$

$$M_{(YB36)} = 4471 \text{"**} *$$

$$M_{(XB36)} = \frac{4471(55.25)}{38.106} = 6490 \text{"**}$$

\* (REF: FZS-36-142, P.I-216  
I-252)

ANALYSIS WING

PREPARED BY B.C. Clayton  
CHECKED BY H. L. K.  
REVISED BY \_\_\_\_\_

## Consolidated Vultee Aircraft Corporation

FORT WORTH DIVISION  
FORT WORTH, TEXAS

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BULKHEAD # 13CHORD MEMBERS (CONT'D)UPPER CHORD MEMBER (ABCD)

## CONDITION I

$$f_c = \frac{P}{A} + \frac{M}{I/C} = \frac{4489}{.9058} + \frac{6490}{2.472} = 7585 \text{#/in}$$

A & I/C TAKEN FROM YB36 REPORT  
FZS-36-142 - CHORD MEMBERS SAME.

$$f_c = 21,900 \text{#/in} \quad (\text{FZS-36-142})$$

$$\text{M.S. COMP.} = \frac{21900}{7585} - 1 = \boxed{+2.68}$$

## CONDITION II

(DGW + ILAA @ 5000')

AXIAL LOAD, P, = 1340# (P. 85) TENSION  
(CRITICAL POINT, X, IS 13" FWD R.S.)

$$X_{\text{ORDINATE}}(\text{YB36}) = 160.394 - .6237 \times 13 * \\ = 152.286 \text{#/in.}$$

$$X_{\text{ORDINATE}}(\text{XB36}) = 183.17 - .6876 \times 13 \quad (\text{P. 73}) \\ = 174.231 \text{#/in.}$$

$$M_{(\text{YB36})} = 12612 \text{**} *$$

$$M_{(\text{XB36})} = 12612 \left( \frac{174.231}{152.286} \right) = 14530 \text{**}$$

\* (REF: FZS-36-142, P. I-223)  
P. I-251

ANALYSIS WING  
PREPARED BY B. Electreton  
CHECKED BY R. Shick  
REVISED BY

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REPORT NO. FZS-36-142  
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DATE 12/47

BULKHEAD #13

CHORD MEMBERS (CONT'D)

UPPER CHORD MEMBER (ABCD)

CONDITION II

$$f_c = \frac{P}{A} + \frac{M}{I/C} = \frac{1340}{.9058} - \frac{14530}{1.294} = -9731 \text{#/in}$$

$$f_c = 25000 \text{#/in} \quad (\text{FZS-36-142 P-I-25})$$

$$\text{M.S. COMP.} = \frac{25000}{9731} - 1 = \boxed{+1.57}$$

LOWER CHORD MEMBER (EFGH) (36W113-6)

THE LOWER CHORD MEMBER IS CRITICAL FOR CONDITION I, DGW-LAA @ 5000'.

THE CRITICAL COMPRESSIVE STRESS OCCURS IN THE LIPPED FLANGE 13" FORWARD OF THE REAR SPAR.

AXIAL LOAD, P, = 3440# (P. 85) TENSION

$$\begin{aligned} \text{XORDINATE(VB36)} &= 193.360 - \frac{57.498}{96.245} \times 13^* \\ &= 185.594 \text{#/in} \end{aligned}$$

$$\begin{aligned} \text{XORDINATE(XB36)} &= 209.460 - .4879 \times 13 \quad (\text{P. 66}) \\ &= 203.117 \text{#/in} \end{aligned}$$

\* (REF : FZS-36-142, P. I-216)

ANALYSIS WING  
PREPARED BY E. Clegg  
CHECKED BY J. H. Smith  
REVISED BY

Consolidated Vultee Aircraft Corporation  
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FORT WORTH, TEXAS

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BULKHEAD #13

CHORD MEMBERS (CONT'D)

LOWER CHORD MEMBER (EFGH)

$$M_{(YB36)} = 15360^{\#} \text{ (FZS-36-142, P. I-256)}$$

$$M_{(XB36)} = 15360 \left( \frac{203.117}{185.594} \right) = 16800^{\#}$$

$$f_c = * \frac{P}{A} + * \frac{M}{I/C} = \frac{3440}{2.612} - \frac{16800}{1.332} \\ = -11282^{\#}/\square"$$

$$F_c = * 25,000^{\#}/\square"$$

$$M.S. = \frac{25000}{11282} - 1 =$$

+1.22

\* (REP: FZS-36-142, P. I-256)

ANALYSIS WING  
PREPARED BY S. J. Flanagan  
CHECKED BY H. E. Dyer  
REVISED BY

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FORT WORTH, TEXAS

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REPORT NO. FZS-36-242  
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DATE 12/47

BULKHEAD #13

INTERCOSTAL ANALYSIS

ANALYSIS OF UPPER INTERCOSTALS

THE UPPER INTERCOSTALS, AS WERE THE CHORD MEMBERS, FOR THE XB36 ARE IDENTICAL TO THOSE OF THE YB36; THEREFORE, THE ONLY CHANGE WILL OCCUR IN THE APPLIED LOADS. A SURVEY OF THE DESIGN CONDITIONS OF THE XB36 PRODUCED THE SAME CRITICAL CONDITION AND INTERCOSTAL THAT WERE CRITICAL FOR THE YB36. THE CRITICAL CONDITION IS DGW = ILAA @ 5000' AND THE INTERCOSTAL JUST AFT OF THE SECOND PANEL POINT IS FOUND TO BE CRITICAL FOR THE COMBINED EFFECTS OF TRANSVERSE SHEAR AND AXIAL LOAD.

THE AVERAGE TRANSVERSE SHEAR FOR THE YB36 WAS TAKEN AS THE AVERAGE SHEAR OVER A DISTANCE OF 8.3", USING THE SHEAR CURVE DEVELOPED (REF: FZS-36-142, P.I-257). IN THIS ANALYSIS THE AVERAGE TRANSVERSE SHEAR IS CONSIDERED PROPORTIONAL TO THE AVERAGE LOADING OVER THE SAME DISTANCE. THE AVERAGE TRANSVERSE SHEAR FOR THE XB36 IS THEN COMPUTED USING THE RATIO OF THE XB36 LOADING TO THE YB36.

ANALYSIS WING  
PREPARED BY B. C. Jones  
CHECKED BY M. L. Morris  
REVISED BY

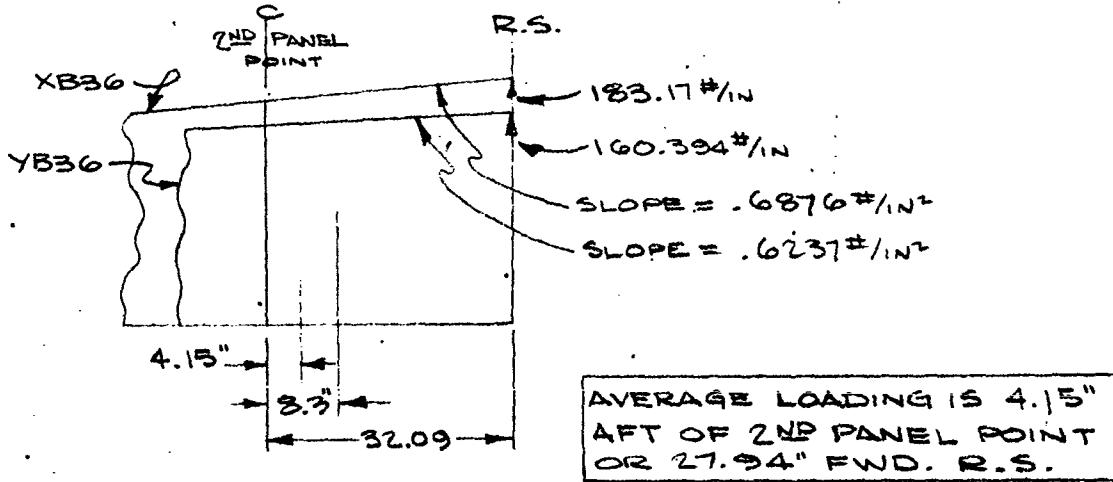
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FORT WORTH DIVISION  
FORT WORTH, TEXAS

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BULK HEAD #13

INTERCOSTAL ANALYSIS

ANALYSIS OF UPPER INTERCOSTALS (CONT'D).



NET LOADING ON UPPER SURFACE

REF : | F2S-36-142 P.I-223  
| P. 1/2 THIS REPORT

$$\text{LOADING FOR YB36} = 160.394 - .6237(27.94) = 142.968\#/\text{in}$$

(27.94" FWD R.S.)

$$\text{LOADING FOR XB36} = 183.17 - .6876(27.94) = 163.958\#/\text{in}$$

(27.94" FWD R.S.)

$$\text{AVERAGE TRANSVERSE SHEAR (YB36)} = 2240\#$$

(P. I-223 F2S-36-142)

$$\text{AVERAGE TRANSVERSE SHEAR (XB36)} =$$

$$2240 \left( \frac{163.958}{142.968} \right) = 2569\#$$

THE INTERCOSTAL LOAD DUE TO TRANSVERSE SHEAR

$$= \frac{VQ}{I} 8.3$$

$$= \frac{2569 \times 1.025 \times 8.3}{5.223} = 4180\#$$

ANALYSIS WING  
PREPARED BY E. Clifton  
CHECKED BY Hegner  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

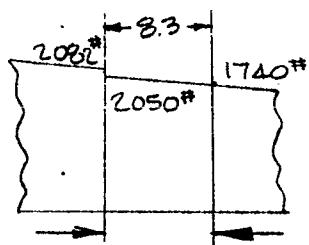
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### BULKHEAD #13

#### INTERCOSTAL ANALYSIS

##### ANALYSIS OF UPPER INTERCOSTALS (CONT'D)

THE INTERCOSTAL LOAD DUE TO THE CHORD MEMBER AXIAL LOAD IS THE DIFFERENCE OF  $P_{1L}$  &  $P_{2L}$  AS SHOWN ON THE ACCOMPANYING SKETCH, WHERE



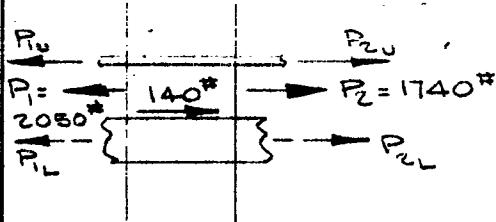
$$P_{1L} = P_1 \frac{A_L}{A_{TOTAL}} = 2050 \frac{.4058}{.9058} = 920\#$$

$$P_{2L} = P_2 \frac{A_L}{A_{TOTAL}} = 1740 \frac{.4058}{.9058} = 780\#$$

(REF: P. 96)

$$P_{1L} - P_{2L} = 920 - 780 = 140\#$$

(REF: FZS-36-142, P. I-259)



$$\text{TOTAL INTERCOSTAL LOAD} = 4180 + 140 = 4320\#$$

$$f_s = \frac{4320}{bt} = \frac{4320}{[4.1-3(1/4)].064} = 20,150\#/in^2$$

THE ALLOWABLE SHEAR STRENGTH OF THE INTERCOSTAL WILL BE TAKEN AS THE CRITICAL BUCKLING STRESS OF THE INTERCOSTAL ELEMENT —  $F_{S_{cr}} = 39,000\#/in^2$   
(FZS-36-142, P. I-260)

$$M.S._{cr.} = \frac{39000}{20150} - 1 =$$

+ .94

ANALYSIS WING  
PREPARED BY B. Clegg  
CHECKED BY H. J. Hause  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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DATE 12/47

## BULKHEAD #13

### INTERCOSTAL ANALYSIS

ANALYSIS OF UPPER INTERCOSTALS (CONT'D)

#### T- SECTION

CHECK OF CRITICAL SECTION OF TEE.

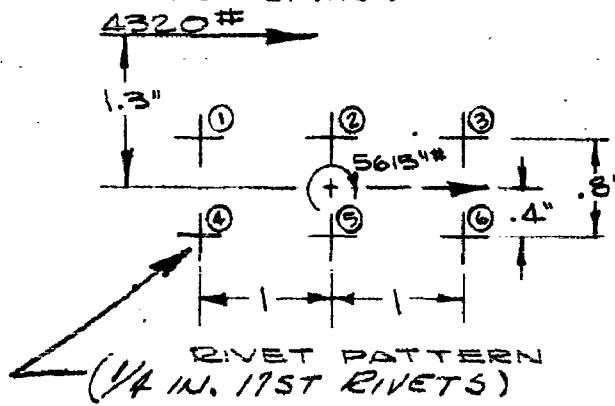
$$J = \frac{4320}{[3 - 3(\frac{1}{4})] \cdot 080} = 24,000 \text{#/in}^2 \text{ REF: P.I.-258 FZS-36-142}$$

$$F_u (\text{GUST ESTIM}) = 37000 \text{#/in}^2$$

$$M.S. = \frac{37000}{24000} =$$

+.54

CHECK OF RIVET PATTERN T-TEE T-SECTION  
TO SKIN.



RIVET	A	X	Y	$Ax^2$	$Ay^2$
1	-	-1	.4	1	.16
2	-	0	.4	0	.16
3	-	1	.4	1	.16
4	-	-1	-.4	1	.16
5	-	0	-.4	0	.16
6	-	1	-.4	1	.16
$\Sigma$				4	.96

CRITICAL RIVETS ① & ③

$$J = \underline{4.96}$$

CONSIDER ①

$$H_D = \frac{4320}{6} = 720 \text{#} \rightarrow$$

$$H_M = \frac{5615}{4.96} \times .4 = 453 \text{#} \rightarrow$$

$$V_M = \frac{5615}{4.96} \times 1 = 1132 \text{#} \uparrow$$

$$P = \sqrt{(1173)^2 + (1132)^2} = 1632 \text{#}$$

$$H = 1173 \text{#} \rightarrow$$

RIVET ALLOWABLE IN SHEAR = 1764#

$$\text{M.S.}_{\text{RIVET}} = \frac{1764}{1632} - 1 =$$

+.08

ANALYSIS WING  
PREPARED BY B. Cliftton  
CHECKED BY H. Clark  
REVISED BY

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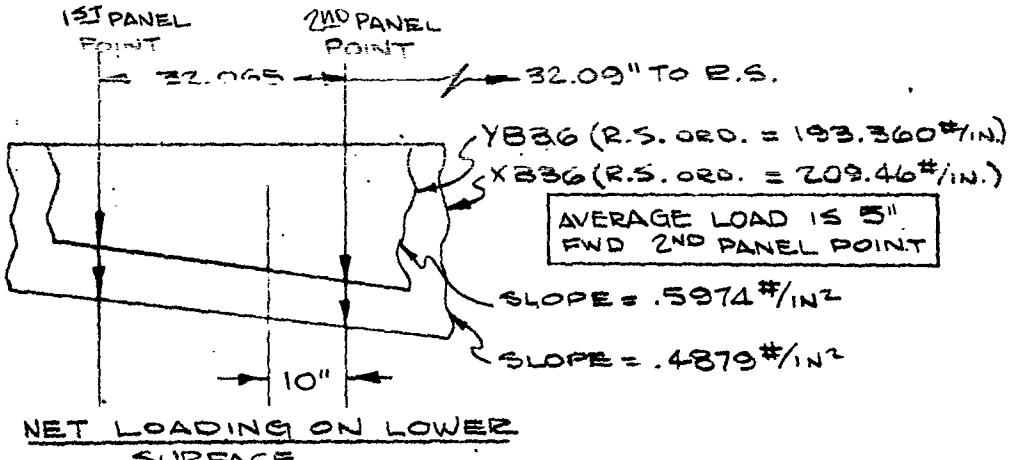
BULKHEAD #13

INTERCOSTAL ANALYSIS

ANALYSIS OF LOWER INTERCOSTALS

THE LOWER INTERCOSTALS FOR THE XB36 ARE IDENTICAL TO THOSE OF THE YB36 FOR THIS BULKHEAD. THE CRITICAL CONDITION IS DOW-LAA @ 5000' AND THE INTERCOSTAL JUST FORWARD OF THE 2ND PANEL POINT IS CRITICAL (AS IN THE YB36 ANALYSIS).

THE TRANSVERSE SHEAR IS OBTAINED BY THE SAME METHOD USED IN THE UPPER INTERCOSTAL ANALYSIS.



REF: | FZS-36-142, P.I.-216  
| P. 15, THIS REPORT

$$\text{LOADING FOR YB36} = 193.360 - 37.09(.5974) = 171.208 \text{#/in}$$

$$\text{LOADING FOR XB36} = 209.46 - 37.09(.4879) = 191.364 \text{#/in}$$

$$\text{AVERAGE TRANSVERSE SHEAR (YB36)} = 2100 \text{#}$$

(FZS-36-142, P.I.-261)

ANALYSIS WING  
PREPARED BY B. C. Lupton  
CHECKED BY N. J. Clark  
REVISED BY \_\_\_\_\_

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BULKHEAD # 13

INTERCOSTAL ANALYSIS

ANALYSIS OF LOWER INTERCOSTALS (CONT'D)

$$\text{AVERAGE TRANSVERSE SHEAR (XB36)} = 2100 \left( \frac{191.364}{171.208} \right) \\ = 2347 \text{ #}$$

THE INTERCOSTAL LOAD DUE TO TRANSVERSE SHEAR

$$= \frac{VQ}{I} \times 10$$

$$= \frac{2347 \times 1.47825 \times 10}{7.466} = 4645$$

THE INTERCOSTAL LOAD DUE TO THE CHORD MEMBER AXIAL LOAD WAS FOUND TO BE NEGLIGIBLE.

$$f_s = \frac{4645}{bt} = \frac{4645}{8.4 \times .051} = 10,830 \text{#/in}$$

THE ALLOWABLE SHEAR STRENGTH OF THE INTERCOSTAL WILL BE TAKEN AS THE CRITICAL BUCKLING STRESS OF THE INTERCOSTAL ELEMENT -  $F_{S_{CR}}$  = 12,100  $\text{#/in}^2$   
(FZS-36-142, P. I-263)

$$M.S._{cre.} = \frac{12100}{10830} - 1 =$$

+.12

ANALYSIS WING  
PREPARED BY Mifford  
CHECKED BY  
REVISED BY

Consolidated Vultee Aircraft Corporation  
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FORT WORTH, TEXAS

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WING BULKHEAD #19  
(36W 119)

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ANALYSIS Wings - Part III  
PREPARED BY Garfield  
CHECKED BY Allen  
REVISED BY \_\_\_\_\_

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BULKHEAD #19 (36W119)

Bulkhead #19 is a truss type bulkhead located 615.375 inches from the airplane center line. It is similar to Bulkhead #19 in the B-36A analysis except for slight differences in the truss tube end connections, truss tubes, and Rear Spar Vertical. The method of analysis is the same as that used for the B-36A (Ref. FZS-36-142, p. I-264 to I-342).

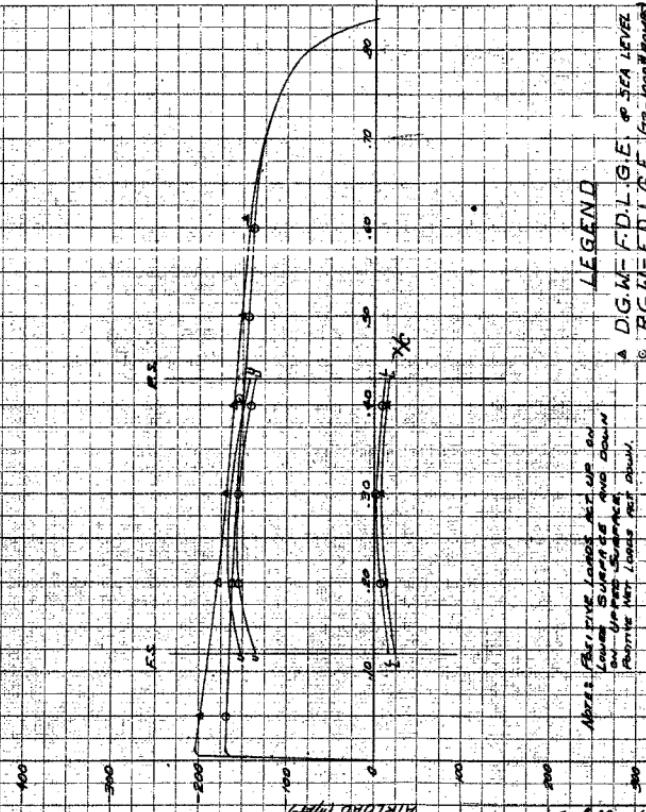
A study of the B-36A critical conditions shows that a check of two conditions for the XB-36 analysis will be adequate.

- I. DGW - FDLGE (Flaps Down Landing Gear Extended) @ Sea Level
- II. RGW - 72-1000# Bombs - FDLGE @ Sea Level

The third and fourth conditions used in the B-36A analysis (Ref. above), RGW-12(4000# Bombs) - ILAA<sub>HS</sub> @ 5000 ft. and RGW-12(4000# Bombs) - ILAA<sub>HS</sub> @ 5000 ft., design the lower chord and intercostals; since the M.S. are high on these members the B-36A analysis will be referred to for this portion of the analysis.

This analysis consists of a tube analysis; check of the critical tube end and critical tube end tie; analysis of upper chord; and an analysis of the rear spar vertical member.

CHORDWISE AIRLOAD DISTRIBUTION  
STATION 19



CALCULATED BY *Conf. 1042*  
DRAWN BY *Conf. 1047*  
STENCILED BY *Conf. 1047*  
APPROVED BY *Conf. 1047*

FIG. 10  
CONSOLIDATED VULTRE AIRCRAFT CORPORATION  
STRUCTURE DIVISION, KIRKWOOD, TEXAS

DOC. NO. *FEB-36260*  
MATERIAL *18-3G*

TABLE III COMPUTATION OF  $N_L$ ,  $N_T$ ,  $M_L$  &  $M_T$  FOR ULT. AIR LOADS  
STATION 19 D.G.W. - F.D.L.G.E @ SEA LEVEL C=266.227" DE=80.475 Chord Date 11/67

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MODEL F-8-36

LEADING EDGE						TRAILING EDGE					
CHORDWISE STATION PL #10 % CHORD FIG. 10	Avg. PL	AREA (5) X .01	DISTANCE FROM 10% LINE ABOUT 10% LINE	MOMENT (6)		CHORDWISE STATION PL #10 % CHORD FIG. 10	S.M.	(8) X (9)	MOMENT MULTIPLIER (10) X (11)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
0	0					80.47	-70	1	-70	6	-420
1	-203	-1.50	.114	-.171		74.225	-118	4	-452	5	2260
2	-203	-2.03	.105	-.213		67.98	-191	2	-262	4	-1048
3	-202	-2.03	.095	-.193		61.735	-141	4	-564	3	-1692
4	-200	-2.01	.085	-.171		55.49	-146	2	-292	2	-584
						49.245	-152	4	-608	1	-608
						43.0	-158	1	-158	0	0
									-2406		2612
CHORDWISE STATION PL #11 % CHORD FIG. 10						DEFINITION OF TERMS:					
4	-200	1	-200	4	-800	$N_L$ = LEADING EDGE AIRLOAD SHEAR					
6	-197	4	-788	3	-2364	$M_L$ = LEADING EDGE AIRLOAD MOMENT ABOUT R.S.					
8	-195	2	-390	2	-780	$N_T$ = TRAILING EDGE AIRLOAD SHEAR					
10	-192	4	-768	1	-768	$M_T$ = TRAILING EDGE AIRLOAD MOMENT ABOUT R.S.					
12	-190	1	-190	0	0						
$ULT. N_L = \frac{1500}{144} \left[ \frac{-2336}{3} - 7.57 \right] = -2496^{#1}$						$ULT. N_T = \frac{1.5(06245)^2 6C}{144} \left[ \frac{-2406}{3} \right] = -5400^{#1}$					

$$ULT. M_L = \frac{156C^2}{144} \left[ \frac{-4112(-.02)}{3} - .748 \right] = -39,520$$

$$ULT. M_T = \frac{1.5(06245)^2 6C^2}{144} \left[ \frac{-66127}{3} \right] = -246,797^{#1}$$

$$ULT. M_L = \frac{156C^2}{144} \left[ \frac{-4112(-.02)}{3} - .748 \right] = -39,520$$

CONSOLIDATED VULTEE AIRCRAFT CORPORATION  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

TABLE IX  
STATION 19

COMPUTATION OF \* $N_s$ ,  $N_u$ ,  $M_s$  &  $M_u$  FOR AIR LOADS  
D.G.W., F.D.L.G.E. @ SEA LEVEL 6339.45' L.C. = 266.277'

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$$\begin{array}{cccccc} 1 & 2 & 3 & 4 & 5 & 6 \\ \text{DISTANCE FROM E.} & \text{P/W/L} & S.M.s & 2 \times 3 & \text{MOMENT} & 4 \times 5 \\ \text{IN FEET (LIMIT)} & & & & \text{MULTIPLIED} & \end{array}$$

$$\begin{array}{cccccc} 7 & 8 & 9 & 10 & 11 & 12 \\ \text{DISTANCE FROM E.} & P/W/L & S.M.s & 3 \times 5 & \text{MOMENT} & 6 \times 10 \\ \text{IN FEET (LIMIT)} & & & & \text{MULTIPLIED} & \end{array}$$

FIG. 19  
COMPOSITE INTERSPAC AIR LOADS

42,000 - 158	1	-158	8	-1264	
20,175 - 121	4	-644	7	-4508	
35,250 - 165	2	-230	6	-1980	
31,575 - 168	4	-672	5	-3360	
27,500 - 172	2	-344	4	-1976	
23,625 - 175	4	-700	3	-2100	
19,750 - 180	2	-360	2	-720	
15,875 - 185	4	-740	1	-740	
12,000 - 190	1	-190	0	0	
		-41.98		-16,048	

FIG. 19  
UPPER SURFACE INTERSPAC AIR LOADS

42,000 - 143	1	-143	8	-1144	
39,125 - 150	4	-600	7	-4200	
35,250 - 157	2	-314	6	-1884	
31,375 - 162	4	-648	5	-3240	
27,500 - 166	2	-332	4	-1328	
23,625 - 167	4	-668	3	-2004	
19,750 - 166	2	-332	2	-662	
15,875 - 160	4	-640	1	-640	
12,000 - 152	1	-152	0	0	
		-38.29		-151.02	

\* DEFINITION OF TERMS:

$N_s$  = TOTAL (UPPER & LOWER) INTERSPAC AIRLOAD SHEAR

$M_s$  = TOTAL (UPPER & LOWER) INTERSPAC AIRLOAD MOMENT

$N_u$  = INTERSPAC AIRLOAD SHEAR (UPPER SURFACE AIRLOAD)

$M_u$  = INTERSPAC AIRLOAD MOMENT (UPPER SURFACE)

$$N_s = \frac{1564}{144} \left[ \frac{(-4.155) - 0.3875}{3} \right] = -5,764 \#$$

$$N_u = \frac{1564}{144} \left[ \frac{(-38.25) - 0.3875}{3} \right] = -5,353 \#$$

$$M_{s5} = \frac{1564^2}{144} \left[ \frac{(-4.155)(0.2875)^2}{3} \right] = -230,611 \#$$

$$M_{u5} = \frac{1564^2}{144} \left[ \frac{(-4.155)(0.2875)^2}{3} \right] = -217,030 \#$$

$$\bar{x} = 40.02" \text{ AFT F.S.}$$

$$\bar{x} = 40.70" \text{ AFT F.S.}$$

ON Loadcell  
Gage No. 4111 year



TABLE VIII COMPUTATION OF  $N_3$ ,  $N_4$ ,  $M_{13}$  &  $M_{14}$  FOR AIRLOADS  
STATION 19

P.G.W./15-1000# BOMBS F.D.L.G.E @ STATION LEVEL 62-38-875" ; C.G. 266-277"

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CONTINUOUS PROFILE  
FOR LOWER SURFACE  
REINFORCED  
LIMITED  
(10 X 5)  
 $M_{13} = 5 M_{12} / 2 \times 3$   
 $M_{14} = 10 M_{12} / 4 \times 5$

CONTINUOUS PROFILE  
FOR UPPER SURFACE  
REINFORCED  
LIMITED  
 $M_{13} = 5 M_{12} / 2 \times 3$   
 $M_{14} = 10 M_{12} / 4 \times 5$

FIG. 1  
COMPOSITE INTERIOR AIR LOADS

	1	2	3	4	5	6	7	8	9	10	11	12
43,000-148	1	-148	8	-184								
39,165-150	4	-600	7	-4200								
35,550-153	2	-306	6	-1836								
31,375-155	4	-620	5	-3100								
27,500-158	2	-316	4	-1264								
23,625-160	4	-640	3	-1920								
19,750-162	2	-324	2	-648								
15,875-164	4	-656	1	-656								
12,000-165	1	-165	0	0								
3,775					12,000-175	1	-125	0	0			
								8,581		14,256		

FIG. 2  
UPPER SURFACE INTERIOR AIR LOADS

	1	2	3	4	5	6	7	8	9	10	11	12
43,000-136	1	-136	8	-188								
39,125-143	4	-572	7	-4004								
35,500-149	2	-298	6	-1788								
31,375-153	4	-612	5	-3060								
27,500-155	2	-310	4	-1240								
23,625-156	4	-624	3	-1872								
19,750-155	2	-310	2	-620								
15,875-146	4	-584	1	-584								
12,000-135	1	-135	0	0								
3,775					12,000-135	1	-135	0	0			
								8,581		14,256		

\* DEFINITION OF TERMS:  
N<sub>3</sub> - TOTAL (UPPER & LOWER) INTERIOR  
AIRLOAD SHEAR  
M<sub>13</sub> - TOTAL (UPPER & LOWER) INTERIOR  
AIRLOAD MOMENT  
N<sub>4</sub> - INTERIOR AIRLOAD SHEAR (UPPER  
SURFACE AIRLOAD)  
M<sub>14</sub> - INTERIOR AIRLOAD MOMENT  
(UPPER SURFACE)

By L. J. Miller  
Check by Mr. H. S. -

$$N_{13} = \frac{1562}{144} \left[ -37751.03875 \right] = -52.55^{\circ} \quad N_{14} = \frac{1562}{144} \left[ -3581(0.03875) \right] = -4.531^{\circ}$$

$$M_{13,14} = \frac{1562^2}{144} \left[ \frac{-14,800(0.03875)^2}{3} \right] = -213.895^{\circ} \quad M_{14,13} = \frac{1562^2}{144} \left[ \frac{-14,256(0.03875)^2}{3} \right] = -209.912^{\circ}$$

X = 40.30.14 AFT E.S.

Z = 41.03 IN AFT E.S.

ANALYSIS WING  
PREPARED BY Canfield  
CHECKED BY Allan  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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BLEND #19

CONDITION I - D.G. W. - F.D. L.G.E. @ SEA LEVEL

AIR LOADS (INTERSPAR)

REPLACING THE AIR LOADS WITH EQUIVALENT TRAPEZOIDS:

COMPOSITE INTERSPAR LOAD =  $N_{IS} = 5763 \text{ ft}^2 \uparrow$   
C.G. AFT OF F.S. = 40.02" (REF: pg. 105)

$$W_{FC} = 76.0 \text{ lb/in} \uparrow$$

$$W_{RC} = 63.9 \text{ lb/in} \uparrow$$

UPPER SURFACE INTERSPAR LOAD =  $N_U = 5,333 \text{ ft}^2 \uparrow$   
C.G. AFT OF F.S. = 40.70" (REF: pg. 105)

$$W_{FU} = 66.8 \text{ lb/in} \uparrow$$

$$W_{RU} = 62.4 \text{ lb/in} \uparrow$$

LOWER SURFACE INTERSPAR LOADS

$$W_{FL} = W_{FC} - W_{FU} = 76.0 - 66.8 = 9.2 \text{ lb/in} \uparrow$$

$$W_{RL} = W_{RC} - W_{RU} = 63.9 - 62.4 = 1.5 \text{ lb/in} \uparrow$$

AIR LOADS (FLAP - 40° DEFLECTION)

FOR 50K F.P.S. GUST

(REF: FZS-36-148, pg. 90 48)

$$R_{190} = 9700 \text{ lb } \uparrow \text{ (ACTING AT C.P. OF FLAPS)}$$

$$R_{190} = -669 \text{ lb } \uparrow$$

THE MAXIMUM PERMISSIBLE SPEED WITH FLAPS DEFLECTED 40° IS THE SAME FOR BOTH THE YB-36 AND THE XB-36. SINCE THE MAXIMUM POSSIBLE  $C_D$  HAS BEEN USED TO DETERMINE THE YB-36 FLAP LOADS, THESE LOADS (REF: FZS-36-148, pg. I-279) ARE CONSERVATIVELY USED FOR THE XB-36 BULGEHEAD ANALYSIS.

$$V_{RS} = 7861 \text{ ft} \uparrow$$

$$P_U = 882 \text{ lb } \rightarrow \text{ (AT UPPER TRUSS PT.)}$$

$$P_L = 4841 \text{ lb } \rightarrow \text{ (AT LOWER TRUSS PT.)}$$

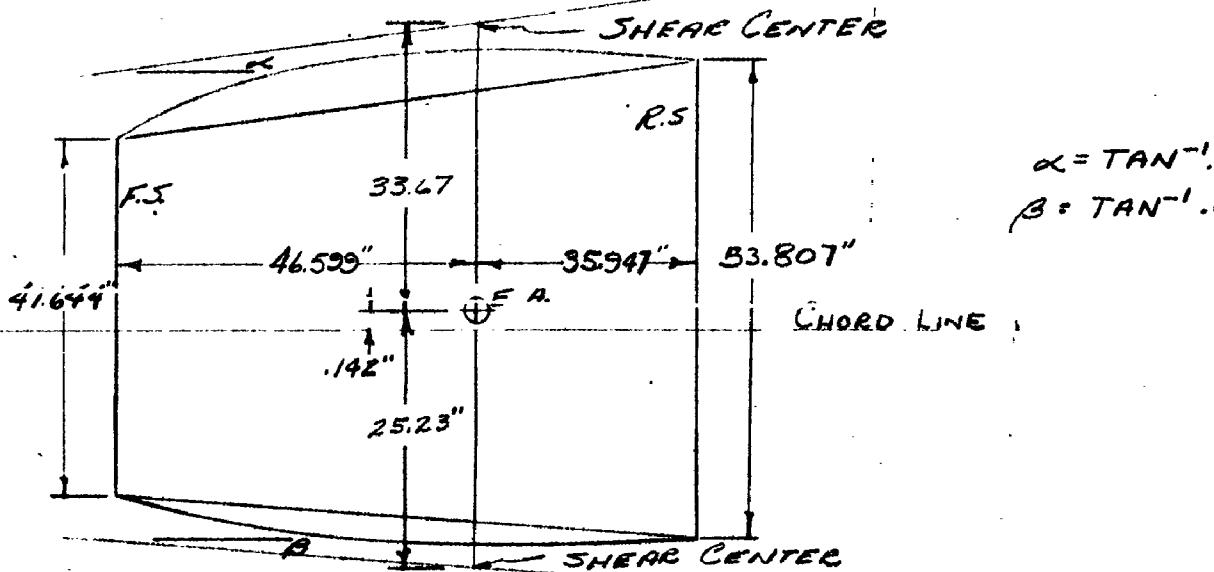
ANALYSIS WING  
PREPARED BY Gafford  
CHECKED BY Allan  
REVISED BY \_\_\_\_\_

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BLK NO. #18  
COND. I

SURFACE LOADS IN THE PLANES OF THE SHEAR  
CENTERS OF THE UPPER AND LOWER SURFACES  
OF THE INTERSPAR BOX:



$$\alpha = \tan^{-1} .10811$$
$$\beta = \tan^{-1} .03924$$

FROM FLAP LOADS: (REF.: F2S-36-142, M.I.-281)

UPPER SURFACE CONTOUR LOAD = 2,466# ←

HORIZONTAL COMPONENT = 2451# ←

LOWER SURFACE CONTOUR LOAD = 3274# ←

HORIZONTAL COMPONENT = 3271# ←

### CRUSHING LOADS

FROM PRELIMINARY CALCULATIONS  $M_x = 28.85 \times 10^6$  IN.#,  
AND SINCE  $M'_x \leq M_x$ , THIS VALUE WILL BE  
USED FOR COMPUTING THE CRUSHING LOADS.

$$E = 10.3 \times 10^6$$

$$L = 38.875$$

$$I_x = 41,174 \text{ IN}^4$$

$$I_x/Q_x = 51.5 \text{ IN}$$

$$\text{CRUSHING LOAD} = \frac{(M'_x)^2 L}{(I_x/Q_x) EI} = \frac{(28.85 \times 10^6)^2 (38.875)}{(51.5)(10.3 \times 10^6)(41,174)}$$
$$= 1481 \text{#}$$

ANALYSIS WING  
PREPARED BY Canfield  
CHECKED BY Allan  
REVISED BY \_\_\_\_\_

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FORT WORTH, TEXAS

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BULKHEAD  
COND. 3

REPLACING THE CRUSHING LOAD WITH THE EQUIVALENT TRAPEZOID SUCH THAT  $\frac{H_c}{H_F} = \frac{W_c}{W_F}$  WHERE  $H_F$  = CONTOUR DEPTH OF FRONT SPAR AND  $H_c$  = CONTOUR DEPTH OF REAR SPAR.

$$H_c = 53.807"; H_F = 41.644"$$

$$W_F = 15.7 \text{#/in.}$$

$$W_c = 20.6 \text{#/in.}$$

### FUEL LOAD

SINCE THIS IS A NORMAL FLIGHT CONDITION THE FUEL LOAD ACTS ON THE LOWER SURFACE.

$$P_{FUEL} = 4186.5 \times 1.5 \times 2.090 = 13,125 \text{#} \quad (\text{REF: F25-36-240), P. 52.}$$

$$\bar{x}_{FUEL} = 77.4 - 31.95 = 45.45" \quad (\text{AFT F. S.)}$$

$$W_{FFUEL} = 112 \text{#/in.} \dagger$$

$$W_{CFUEL} = 206 \text{#/in.} \dagger$$

### COMBINED AIR (INTERSPAR), CRUSHING AND FUEL LOADS ACTING ON BULKHEAD

#### UPPER SURFACE

$$\begin{aligned} \text{F. S. ORDINATE} &= W_{FAIR} + W_{FCRUSH} \\ &= 66.8 - 15.7 = 51.1 \text{#/in.} \dagger \end{aligned}$$

$$\begin{aligned} \text{R.S. ORDINATE} &= W_{RAIR} + W_{RCRUSH} \\ &= 62.4 - 20.6 = 41.8 \text{#/in.} \dagger \end{aligned}$$

#### LOWER SURFACE

$$\begin{aligned} \text{F.S. ORDINATE} &= W_{FAIR} + W_{FCRUSH} + W_{FFUEL} \\ &= 15.7 + 9.2 - 112 = -87.1 \text{#/in.} \dagger \end{aligned}$$

$$\begin{aligned} \text{R.S. ORDINATE} &= W_{RAIR} + W_{RCRUSH} + W_{FFUEL} \\ &= 20.6 + 1.5 - 206 = -183.9 \text{#/in.} \dagger \end{aligned}$$

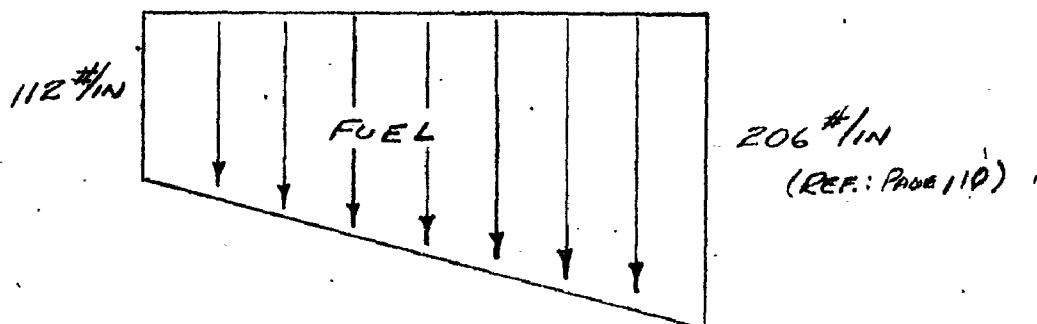
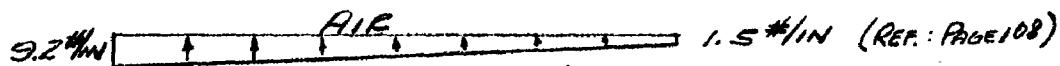
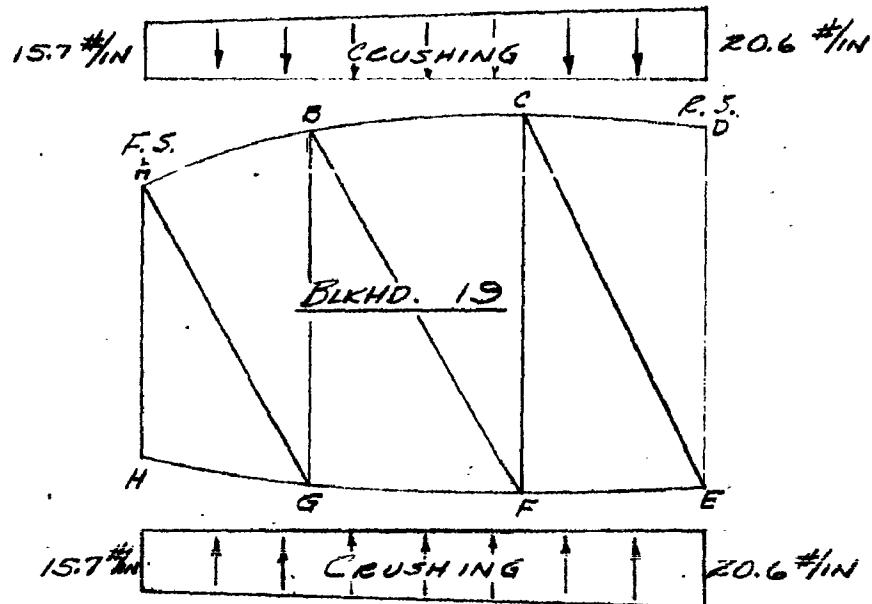
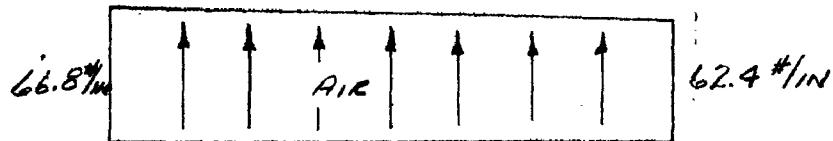
ANALYSIS Wings  
PREPARED BY Canfield  
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BIRHD. #19  
COND. I



INTERSPAR LOADING DIAGRAM  
BLKHD. #19 (D.G.W. - F.O. L.G. E. @ SEA LEVEL)

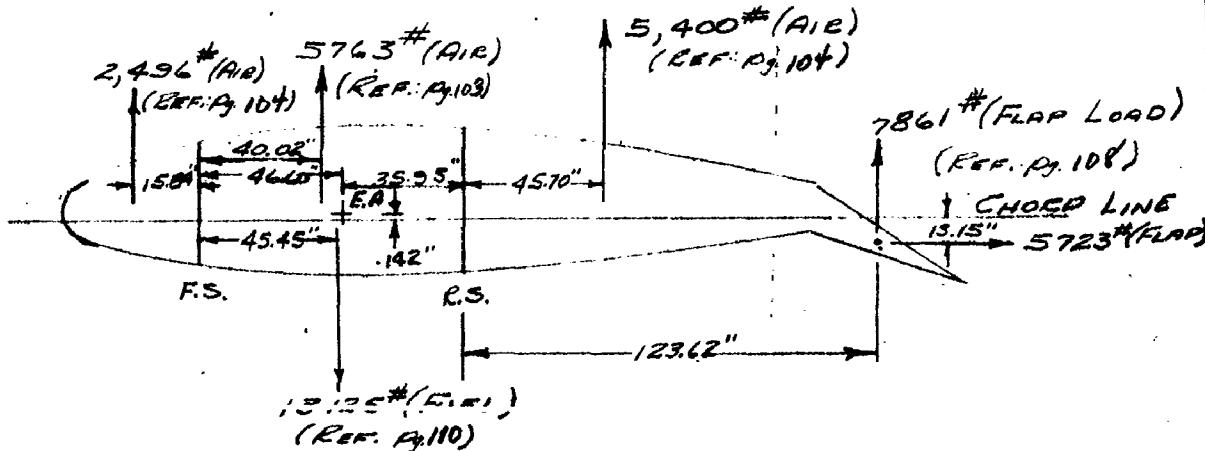
ANALYSIS WING  
PREPARED BY Campfield  
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BLEND. #19  
COND. I

WING STATION LOADING



APPLIED LOADS ON BULKHEAD

TRANSFERRING ALL FORCES TO THE E.A.

$$\begin{aligned} V &= N_{Lx} + N_{Lz} + N_{Tx} + V_{FLAP} + P_{FUEL} \\ &= 2496 + 5763 + 5400 + 7861 - 13125 \\ &= 8,395 \# \end{aligned}$$

$$D = D_{FLAP} = 5723 \# \rightarrow$$

$$\begin{aligned} TEA &= (2496)(15.84 + 46.60) + (5763)(46.60 - 40.02) \\ &\quad - (5400)(35.95 + 45.70) - (7861)(35.95 + 123.62) \\ &\quad - (13125)(46.60 - 45.45) - (5723)(15.15 + .142) \\ &= -1,592,672 \# \end{aligned}$$

SHEAR FLOW ON F.S. AND R.S. DUE TO V

$$V_{F.S.} = \frac{35.95}{82.55} (8,395) = 3656 \# \downarrow$$

$$V_{R.S.} = V - V_{F.S.} = 8,395 - 3656 = 4739 \# \downarrow$$

$$8V_{F.S.} = \frac{3656}{41.64} = 87.8 \#/\text{in.} \downarrow (* \text{ F.S. \& R.S. DEPTHS })$$

$$8V_{R.S.} = \frac{4739}{53.81} = 88.1 \#/\text{in.} \downarrow$$

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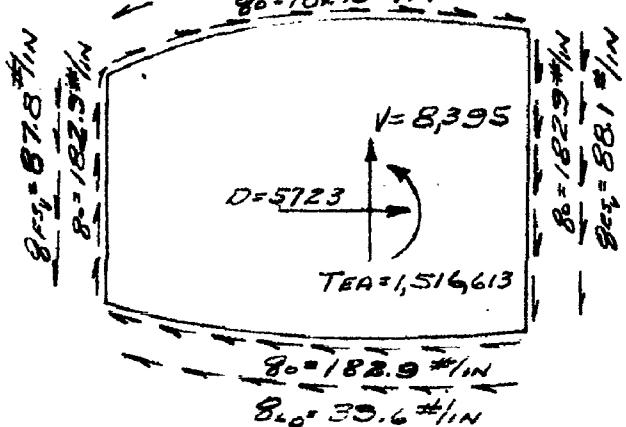
SHEAR FLOW DUE TO TEA:

$$8_0 = \frac{TEA}{2A} = \frac{1,532,672}{8707} = 182.9 \text{#/in}$$

SHEAR FLOW DUE TO DRAG LOAD

$$8_4 = \frac{2451}{82.55} = 29.7 \text{#/in} \leftarrow \quad (\text{REF.: pg. 109})$$

$$8_6 = \frac{3271}{82.55} = 39.6 \text{#/in} \leftarrow \quad (\text{REF.: pg. 109})$$



BLKHD. #19. APPLIED SHEAR FLOWS  
(D.G.W.-F.O. L.G.E. @ SEA LEVEL)

NET SHEAR FLOW

$$8_{FS} = 182.9 - 87.8 = 95.1 \text{#/in} \uparrow$$

$$8_{RS} = 182.9 + 88.1 = 271.0 \text{#/in} \downarrow$$

$$8_{US} = 182.9 - 29.7 = 153.2 \text{#/in} \leftarrow$$

$$8_{LS} = 182.9 + 39.6 = 222.5 \text{#/in} \leftarrow$$

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REACTIONS AT F.S. AND R.S. DUE TO VERTICAL  
COMPONENTS OF SURFACE LOADS.

$$V_{RS} = (29.7)(8.92) = 266 \# \uparrow$$

\* DIFFERENCE  
BETWEEN F.S. & R.S  
ABOVE AND BELOW  
THE CHORD LINE.

$$V_{FS} = (39.6)(3.24) = 129 \# \uparrow$$

$$V_{BR} = 266 - 129 = 137 \# \uparrow \text{ (ACTING AT E.A.)}$$

$$V_{RS} = \frac{46.60}{82.55} \times 137 = 77 \# \uparrow$$

$$V_{FS} = 137 - 77 = 60 \# \uparrow$$

NET APPLIED SHEAR ON FRONT FREAK SPAR

$$F.S. = (95.1)(41.64) + 60$$

$$= 4020 \# \uparrow$$

$$R.S. = (271.0)(53.81) - 77$$

$$= 14,506 \# \uparrow$$

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BLDG. #19  
CONO. I

BREAKDOWN OF NET AIR, CRUSHING, AND FUEL  
LOADS INTO PANEL POINT LOADS.

UPPER SURFACE

$$P_A = 770 \# \uparrow$$
$$P_B = 1342 \# \uparrow$$
$$P_C = 1168 \# \uparrow$$
$$P_D = 562 \# \uparrow$$

(REF. PG. III FOR  
LOCATION OF PANEL  
POINTS)

LOWER SURFACE

$$P_E = 2327 \# \uparrow$$
$$P_F = 4000 \# \uparrow$$
$$P_G = 3409 \# \uparrow$$
$$P_H = 1456 \# \uparrow$$

CORRECTION LOADS

CORRECTION LOADS ARE APPLIED TO THE FRONT  
AND REAR SPARS TO ACCOUNT FOR THE TRANSFER  
OF THE SHEAR FLOW FROM THE CONTOURS  
TO THE CENTROIDS OF THE STRAIGHT LINE  
CHORD MEMBERS.

UPPER SURFACE

$$T = 2 A_u g_u^* - g_u y_u C = [2(202) - (2.13)(82.55)] 153.2 \\ = 34884 \text{ IN}^{\#}$$
$$R_{UFR} = \frac{34884}{82.55} = 423 \# \uparrow$$

\* REF. PG. 113

LOWER SURFACE

$$T = 2 A_u g_u^* - g_u y_u C = [2(89) - (1.79)(82.55)] 222.5 \\ = 25,143$$
$$R_{LFR} = \frac{25,143}{82.55} = 305 \# \uparrow$$

CORRECTED PANEL POINT LOADS AT F.S. & R.S.

UPPER SURFACE

$$P_A = 770 \# + 423 = 1193 \# \uparrow$$

$$P_D = 562 - 423 = 139 \# \uparrow$$

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BLKHD. #10  
COND. I

LOWER SURFACE

$$P_H = 1456 - 305 = 1151 \# \uparrow$$

$$P_E = 2527 + 305 = 2632 \# \downarrow$$

COUPLE AT FRONT SPAR RESULTING FROM  
LEADING EDGE AIR LOAD:

$$\frac{M_L}{38.72} = \frac{39520}{38.72} = 1020 \# \leftarrow$$

COUPLE AT REAR SPAR RESULTING FROM  
TRAILING EDGE AIR LOAD:

$$\frac{M_T}{50.88} = \frac{246797}{50.88} = 4850 \# \leftarrow$$

COUPLE AT REAR SPAR RESULTING FROM  
VERTICAL COMPONENT OF FLAP LOAD (40° DEFLECTION)

$$\frac{M_{VFBs}}{50.88} = \frac{7861 \times 123.62}{50.88} = 19100 \# \leftarrow$$

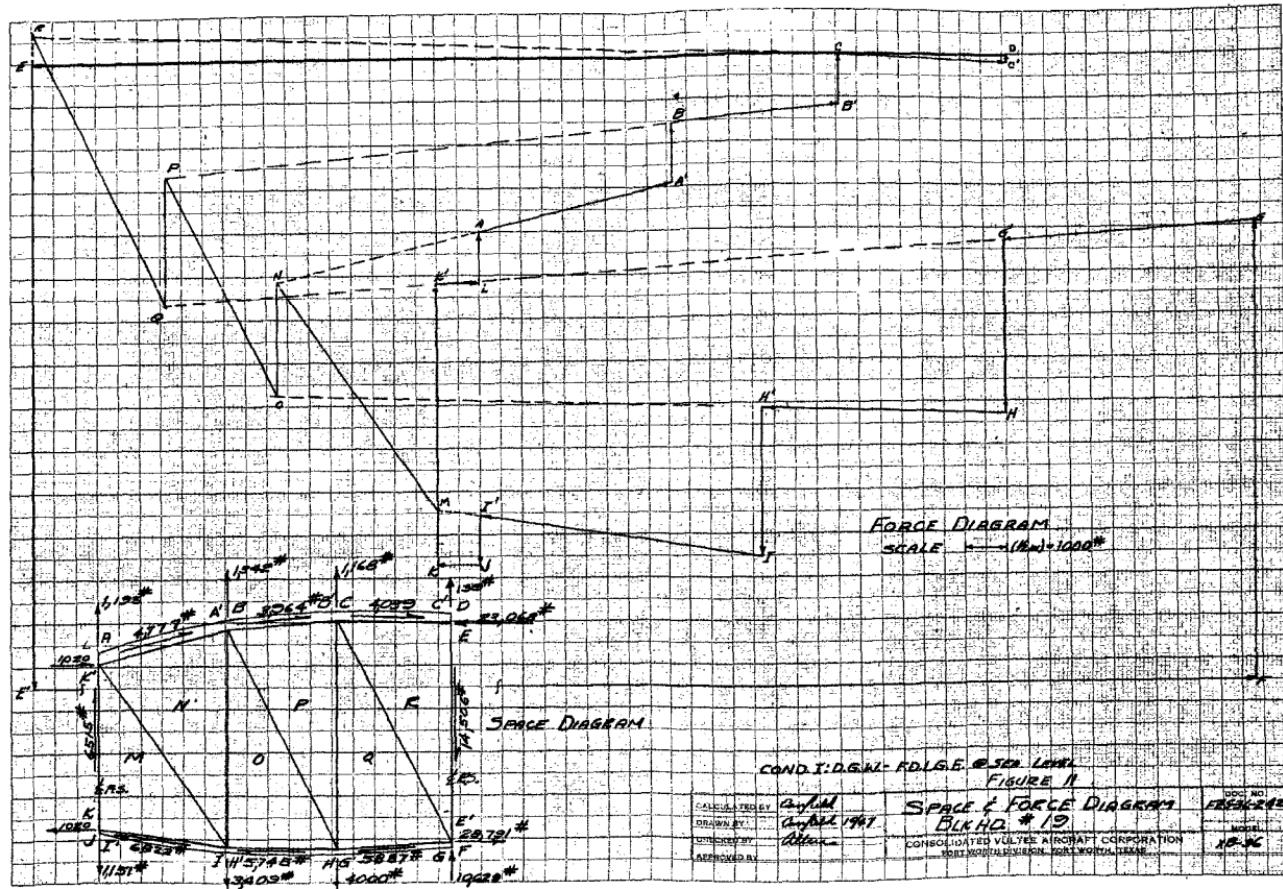
NET HORIZONTAL LOADS AT TRUSS PTS. OF REAR  
SPAR

$$P_H = 4850 + 19100 - 882 = 23,068 \# \leftarrow$$

$$P_E = 4850 + 19100 + 4841 = 28,791 \# \leftarrow$$

VERTICAL LOAD AT R.S. LOWER PANEL POINT

$$P_E = 5400 + 7861 - 2632 \\ = 10,629 \# \uparrow$$



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BLKH'D. #19

CONDITION II - R.G.W. (92-1000# Bombs), F.O.L.G.E. @ Sea Level

AIR LOADS (INTERSPAR)

REPLACING THE AIR LOADS WITH EQUIVALENT  
TRAPEZOIDALS:

COMPOSITE INTERSPAR LOAD =  $N_{15} = 5,255^{\#}$  ↑

C.G. AFT. OF F.S. = 40.50 IN.

$W_{F_U} = 67.4 \text{#/in.}$  ↑ (REF: Pg. 107)

$W_{R_U} = 60.0 \text{#/in.}$  ↑

UPPER SURFACE INTERSPAR LOAD =  $N_U = 4,987^{\#}$  ↑

C.G. AFT. OF F.S. = 41.08 IN.

$W_{F_U} = 61.0 \text{#/in.}$  ↑ (REF: Pg. 107)

$W_{R_U} = 59.8 \text{#/in.}$  ↑

LOWER SURFACE INTERSPAR LOAD:

$W_F_L = W_{F_U} - W_{R_U} = 6.4 \text{#/in.}$  ↑

$W_{R_L} = W_{R_U} - W_{F_U} = .2 \text{#/in.}$  ↑

AIR LOADS (FLAP)

SINCE THE DESIGN FLAPS DOWN SPEED FOR THIS CONDITION & THE O.G.W.-FOLGE. CONDITION ARE THE SAME, THE FLAP LOADS FOR THE TWO CONDITIONS ARE TAKEN TO BE THE SAME. REF. COND. I.

NET VERTICAL LOAD =  $7861^{\#}$  ↑

NET HORIZONTAL LOAD =  $5723^{\#}$  →

C.G. IS 123.62" AFT  
OF R.S.

$P_U = 882^{\#}$  → (REF: Pg. 108)

$P_L = 4841^{\#}$  →

AIR LOADS (COMBINED TR. EDGE & FLAP AT TROSS PTS.  
OF RIB SPAR)

$$H_{E.S. \text{ UPPER}} = \frac{(7861)(123.62)}{50.88} + \frac{241,983}{50.88} - 882 \\ = 22,974^{\#} \rightarrow$$

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$$H_{R.S. LOWER} = 19100 + 4756 + 4841 \\ = 28,697 \# \rightarrow$$

BLKH.D. #19  
COND. II

$$V_{R.S. LOWER} = 5237 + 7861 = 13,098 \# \downarrow$$

### CRUSHING LOADS

FROM PRELIMINARY CALCULATIONS  $M_x = 24.55 \times 10^6$  IN.<sup>#</sup>  
AND SINCE  $M'_x \leq M_x$  THIS VALUE WILL BE  
USED FOR COMPUTING THE CRUSHING LOADS.

$$E = 10.3 \times 10^6$$

$$L = 38.875$$

$$I_x = 41174 \text{ IN}^4$$

$$I_x/Q_x = 51.5 \text{ IN}$$

$$\text{CRUSHING LOAD} = \frac{(M_x)^2 L}{(I_x/Q_x) EI} = \frac{(24.55 \times 10^6)^2 (38.875)}{(51.5)(10.3 \times 10^6)(41174)} \\ = 1,070 \#$$

REPLACING THE CRUSHING LOAD WITH THE  
EQUIVALENT TRAPEZOID SUCH THAT  $\frac{H_R}{H_F} = \frac{W_R}{W_F}$

WHERE  $H_F$  = CONTOUR DEPTH OF FRONT SPAR  
AND  $H_R$  = CONTOUR DEPTH OF REAR SPAR.

$$H_R = 53.807" ; H_F = 41.644"$$

$$W_F = 11.32 \#/\text{IN}$$

$$W_R = 14.61 \#/\text{IN}$$

### FUEL LOAD

SINCE THIS IS A NORMAL FLIGHT CONDITION  
THE FUEL LOAD ACTS ON THE LOWER SURFACE.

$$P_{FUEL} = 1.5 \times 2.250 \times 2761 = 9,356 \# \downarrow$$

(REF: F25-36-240, pg. 58)

$$\bar{x}_{FUEL} = 77.2 - 31.95 = 45.25 \text{ IN. (AFT. F. S.)}$$

$$W_{FUEL} = 81 \#/\text{IN.}$$

$$W_{R.FUEL} = 146 \#/\text{IN.}$$

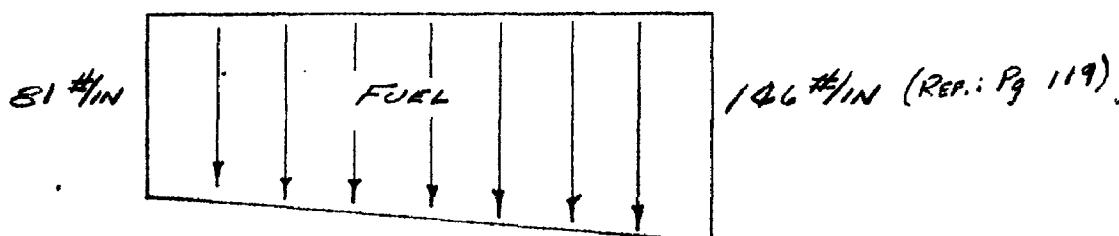
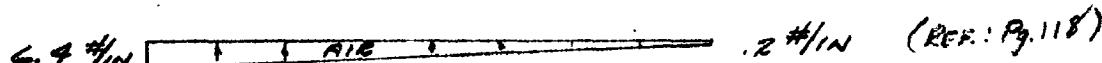
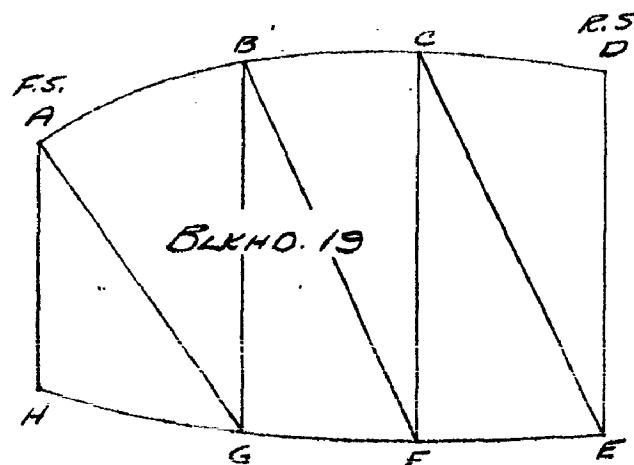
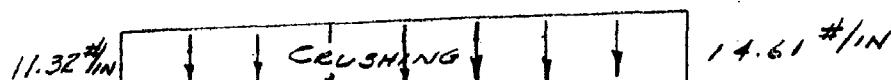
ANALYSIS WING  
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BLKHLD #19

COND. II



INTERSPAR LOADING DIAGRAM  
BLKHLD. #19

R.G.W. (72-1000# BOMBS), F.D.L. G. E. @ SEA LEVEL

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COMBINED AIR (INTERSPAR), CRUSHING AND FUEL  
LOADS ACTING ON BULKHEAD

UPPER SURFACE :

$$\text{F.S. ORDINATE} = W_{\text{FAIR}} + W_{\text{FCRUSH}} \\ = 61.0 - 11.32 = 49.68 \text{#/in} \uparrow$$

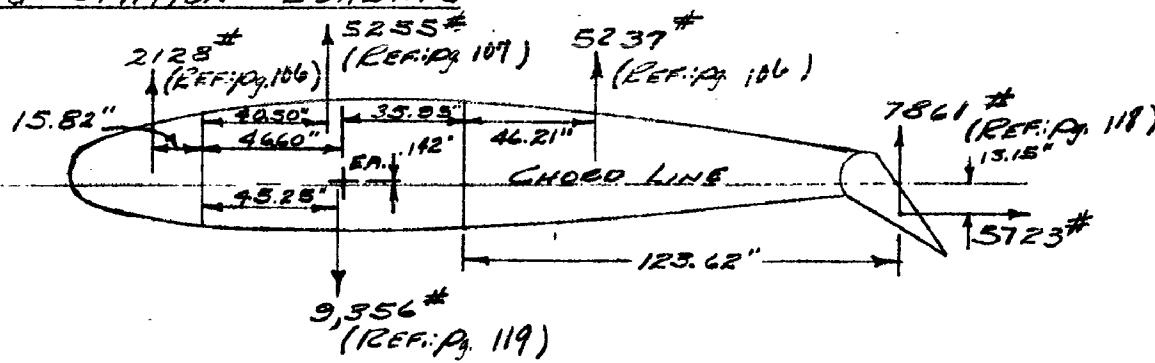
$$\text{P.S. ORDINATE} = W_{\text{RAIR}} + W_{\text{RCRUSH}} \\ = 59.8 - 14.61 = 45.19 \text{#/in} \uparrow$$

LOWER SURFACE

$$\text{F.S. ORDINATE} = W_{\text{FAIR}} + W_{\text{FCRUSH}} + W_{\text{FFUEL}} \\ = 6.4 + 11.32 - 81.0 = -63.28 \text{#/in} \uparrow$$

$$\text{P.S. ORDINATE} = W_{\text{RAIR}} + W_{\text{RCRUSH}} + W_{\text{RFUEL}} \\ = .2 + 14.61 - 146 = -131.19 \text{#/in} \uparrow$$

WING STATION LOADING



APPLIED LOADS ON BULKHEAD

TRANSFERRING ALL FORCES TO THE E.A.

$$V = 2128 + 5255 + 5237 + 7860 - 9356 = 11,124 \text{#} \uparrow$$

$$D = D_{\text{FLAP}} = 5,723 \text{#} \uparrow$$

$$\begin{aligned} T_EA &= (2128)(15.82 + 46.60) + 5255(46.60 - 40.50) \\ &\quad - (5237)(35.55 + 46.21) - (7860)(35.55 + 123.62) \\ &\quad - (5723)(.142 + 13.15) - (9356)(46.60 - 45.25) \\ &= -1,608,296 \text{#} \uparrow \end{aligned}$$

ANALYSIS Wing  
PREPARED BY Canfield  
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CON.O IISHEAR FLOW ON F.S. AND E.S. DUE TO V

$$V_{FS} = \frac{35.95}{82.55} (11,124) = 4,845 \text{ # ft}$$

$$V_{ES} = V - V_{FS} = 6,279 \text{ # ft}$$

$$S_{FS} = \frac{4845}{41.64} = 116.4 \text{#/in} \uparrow \quad *(\text{F.S. & E.S. DEPTHS})$$

$$S_{ES} = \frac{6279}{53.81} = 116.7 \text{#/in} \uparrow$$

SHEAR FLOW DUE TO TEA:

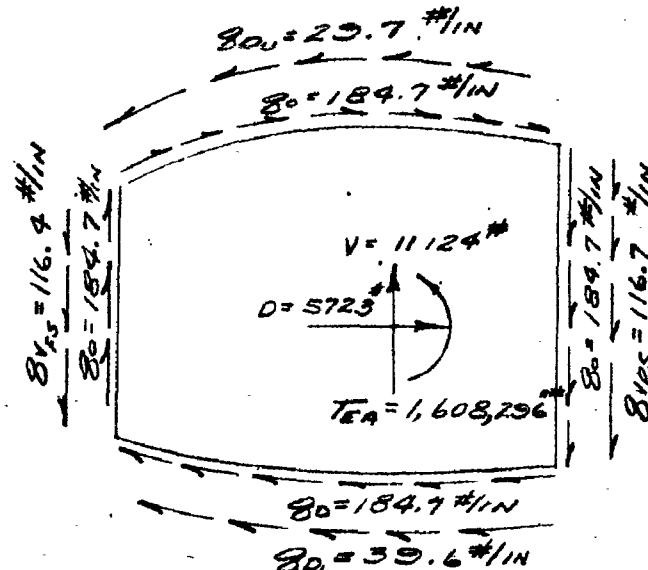
$$S_0 = \frac{TEA}{2A} = \frac{1,608,296}{8707} = 184.7 \text{#/in} \uparrow$$

SHEAR FLOW DUE TO DRAG LOAD

$$S_0 = 29.7 \text{#/in} \leftarrow$$

(Ref: pg. 119)

$$S_0 = 39.6 \text{#/in} \leftarrow$$



BLKHD. 19 - APPLIED SHEAR FLOWS  
R.G.W. (72-1000 \* 80005) F.D.L.G.E. @ SEA LEVEL

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BLOCK O. #19  
CORR II

NET SHEAR FLOWS

$$S_{FS} = 184.7 - 116.4 = 68.3 \text{#/in} \uparrow$$

$$S_{RS} = 184.7 + 116.7 = 301.4 \text{#/in} \uparrow$$

$$S_U = 184.7 - 29.7 = 155.0 \text{#/in} \rightarrow$$

$$S_L = 184.7 + 39.6 = 224.3 \text{#/in} \leftarrow$$

REACTIONS AT F.S. AND R.S. DUE TO VERTICAL  
COMPONENTS OF SURFACE LOADS.

$$V_{RS} = 77 \text{#} \uparrow \quad (\text{REF.: Pg. 114})$$

$$V_{FS} = 60 \text{#} \uparrow$$

NET APPLIED SHEAR ON FRONT & REAR SPAC

F.S.

$$V = (68.3)(41.64) + 60 = 2,904 \text{#} \uparrow$$

R.S.

$$V = (301.4)(53.81) - 77 = 16,141 \text{#} \uparrow$$

BREAKDOWN OF NET AIR, CRUSHING, AND FUEL  
LOADS INTO PANEL POINT LOADS.

UPPER SURFACE

$$P_A = 748 \text{#} \uparrow$$

$$P_B = 1350 \text{#} \uparrow$$

$$P_C = 1216 \text{#} \uparrow$$

$$P_D = 601 \text{#} \uparrow$$

(Ref.: Pg. III FOR LOCATION  
OF PANEL POINTS)

LOWER SURFACE

$$P_E = 1660 \text{#} \uparrow$$

$$P_F = 2859 \text{#} \uparrow$$

$$P_G = 2452 \text{#} \uparrow$$

$$P_H = 1055 \text{#} \uparrow$$

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### CORRECTION LOADS

CORRECTION LOADS ARE APPLIED TO THE FRONT AND REAR SPARS TO ACCOUNT FOR THE TRANSFER OF THE SHEAR FLOW FROM THE CENTRODES TO THE CENTROIDS OF THE STRAIGHT LINE CHORD MEMBERS.

### UPPER SURFACE

$$T = 2 A_u g_u - g_u Y_u C = [2(202) - 2.13(82.55)] 1.55 = 35,340 \text{ "}"$$

$$R_{U\text{F}\&E} = \frac{35340}{82.55} = 428 \text{ # } \uparrow \uparrow$$

### LOWER SURFACE

$$T = 2 A_L g_L - g_L Y_L C = [2(83) - (79)(82.55)] 226.5 = 25,346 \text{ "}"$$

$$R_{L\text{F}\&E} = \frac{25346}{82.55} = 307 \text{ # } \uparrow \uparrow$$

### CORRECTED PANEL POINT LOADS AT F.S. & R.S.

#### UPPER SURFACE

$$P_A = 748 + 428 = 1176 \text{ # } \uparrow$$

$$P_B = 601 - 428 = 173 \text{ # } \uparrow$$

#### LOWER SURFACE

$$P_A = 1055 - 307 = 748 \text{ # } \uparrow$$

$$P_B = 1660 + 307 = 1967 \text{ # } \uparrow$$

### COUPLE AT F.S. RESULTING FROM LEADING EDGE AIR LOAD

$$\frac{M_L}{38.72} = \frac{35656}{38.72} = 869 \text{ # } \leftarrow$$

### COUPLE AT R.S. RESULTING FROM TRAILING EDGE AIR LOAD

$$\frac{M_T}{50.88} = \frac{241,983}{50.88} = 4756 \text{ # } \leftarrow$$

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COUPLE AT R.S. RESULTING FROM VERTICAL  
 COMPONENT OF FLAP LOAD (40° DEFLECTION)

$$\frac{M_{VFS3}}{50.88} = \frac{7861 \times 123.62}{50.88} = 19,100 \# \rightarrow$$

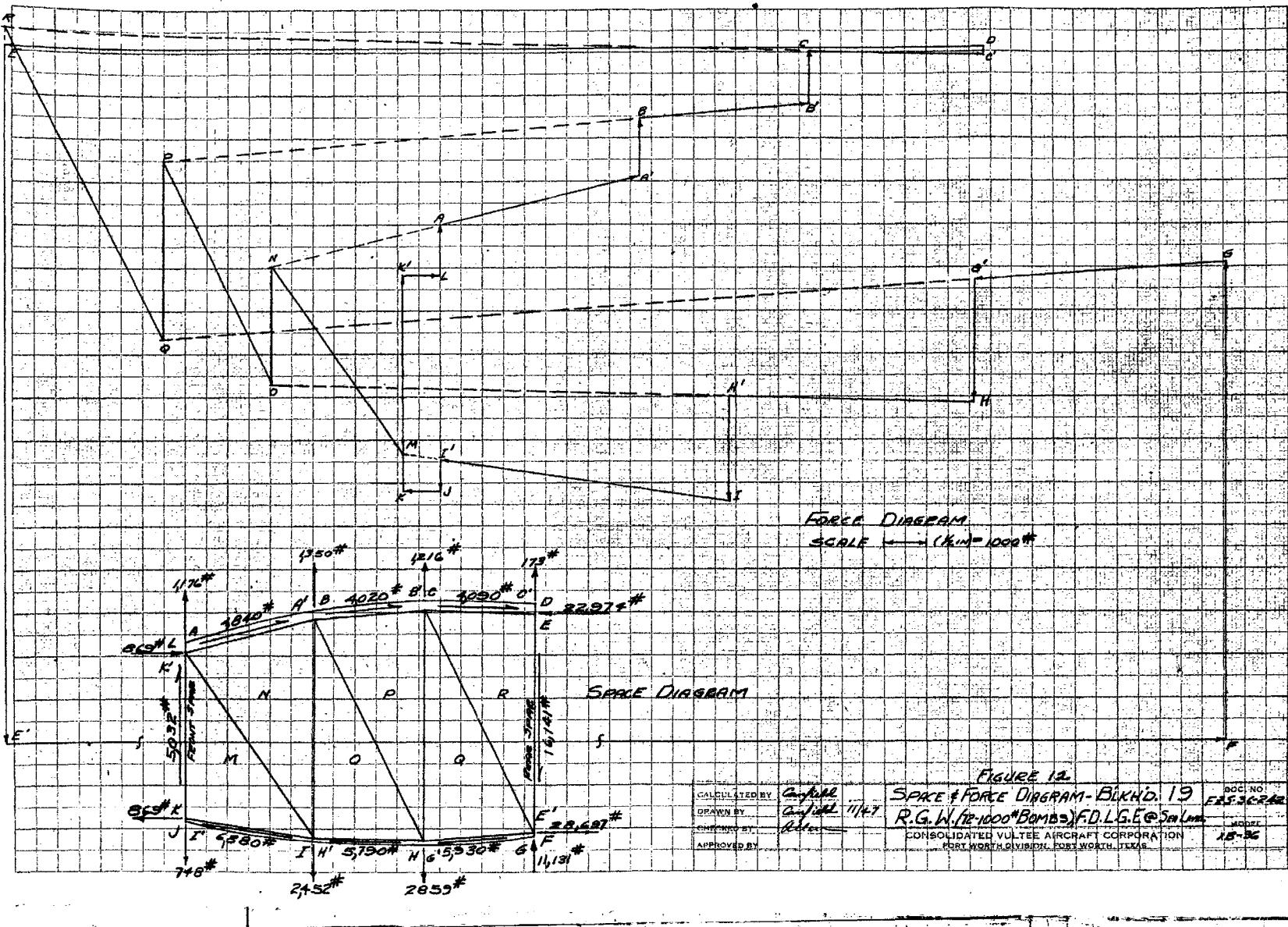
NET HORIZONTAL LOADS AT TEUSS PTS. OF  
 REAR SPAR

$$P_{RH} = 4756 + 19100 - 882 = 22,974 \# \rightarrow$$

$$P_{RH} = 4756 + 19100 + 1841 = 28,697 \# \rightarrow$$

VERTICAL LOAD AT R.S. LOWER PANEL POINT

$$\begin{aligned} P_E &= 7861 - 1967 + 5237 \\ &= 11,131 \# \uparrow \end{aligned}$$



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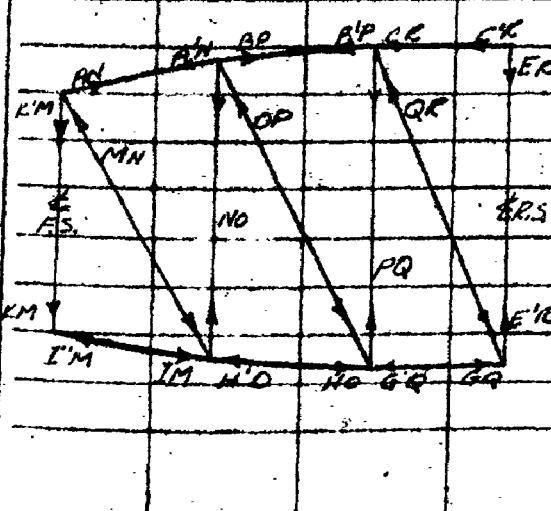
FW 833 125 PADS 11-43

BLK NO. #19 - MEMBER LOAD SUMMARY &amp; COMPARISON - XB-36 &amp; B-36A

## TABLE XII

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MEMBER	XB-36		B-36A		MAXIMUM LOADS	
	D.G.W. (72-100% BONES)	FOLGE, GSEA LEVEL GSEA LEVEL	D.G.W. (72-100% BONES) REF: F25-36-142, PAGE I-315	FOLGE, GSEA LEVEL GSEA LEVEL	TEN.	COMP.
VER. A.O.H MOS 117	REF: FG-72 MOS 126					
A'N	-4,890	-4,070	-4,340	-3,560		
A'N	-9,620	-8,900	-9,360	-8,580		
BP	-12,000	-11,250	-11,535	-10,800		
B'P	-15,980	-15,290	-15,700	-14,965		
CP	-19,000	-18,890	-18,750	-18,600		
C'R	-23,050	-22,960	-23,000	-22,840		
ER	-690	-400	-1,200	-1,070		
E'R	-13,200	-16,560	-15,860	-17,330		
GQ	+25,730	+25,100	+25,690	+24,935		
G'Q	+19,950	+19,170	+19,600	+18,855		
HO	+17,200	+16,560	+17,140	+16,405		
H'Q	+11,420	+10,790	+11,200	+10,465		
IM	+7,790	+7,780	+7,930	+7,790		
I'M	+1,020	+890	+870	+740		
KM	+1,230	+880	+935	+400		
K'M	-5,270	-4,170	-4,785	-3,645		
MN	+6,480	+5,360	+6,040	+4,950	+6,480	-1,800
NO	-2,630	-2,750	-3,200	-3,260	+3,135	-2,750
OP	+5,710	+5,900	+5,665	+5,665	+5,800	-500
PQ	-2,970	-4,150	-4,100	-5,245	+2,610	-4,150
QR	+7,020	+8,050	+7,300	+8,600	+8,050	



\* USED B-36A VALUES FROM  
F25-36-142, PAGE I-315

REPORT No: F25-36-242

MODEL: XB-36

By: Confield

CHkd by: Allen

DATE: 11-47

CONSOLIDATED VULTEE AIRCRAFT CORPORATION  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

FW 535 125 PAGE 11-47

## TABLE XXIX TUBULAR MEMBERS IN COMPRESSION &amp; TENSION

BULKHEAD 19

REPORT NO. F-653-26  
Model X-01-36  
DATE 11-47

MEMBER	Max. Com. Load (lb.)	TUBE NO.	SIZE OF TUBE	PIPE S. OF TUBE (in.)	FC (lb/in.)	L (in.)	I 1/4A 1/8P	FC M.S.	TENSILE TEST					
									5	6	7	8		
MN 1800	360	3666-6	1.5 x 1.5 x .032	.2149	8,376	46	.0846	.6274	73.3	12,600	+.51	6,480	30,200	+.62
NO 2750	36W112-49	—	1.5 x 1.5 x .040	.2660	10,240	46	.1058	.6310	72.9	16,500	+.40	3,135	11,800	+.35
OF 500	3661366-6	—	1.5 x 1.5 x .032	.2149	2,327	50	.0846	.6274	79.6	10,600	+.55	5,800	26,950	+.82
PQ 4150	36W112-40	—	2 x 1.5 x .040	.3180	13,050	50	.1884	.7710	64.8	20,000	+.53	2,610	8,210	+.96
QR —	36R1366-8	—	1.5 x 1.5 x .040	.2784	—	51	.1152	.6934	75.3	13,700	—	8,050	18,900	+.70

\* DISTANCE BETWEEN C.G.'S OF ATTACHING PIVETS

By: Carlill  
Chkd By: Almon

ANALYSIS WING  
PREPARED BY Coxfield  
CHECKED BY Allen  
REVISED BY:

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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MODEL XB-36  
DATE 11/47

BLD NO. #10

TUBE END OP IN TENSION

THE CRITICAL BENDING STRESSES IN AN END CONNECTION OCCUR IN MEMBER OP:

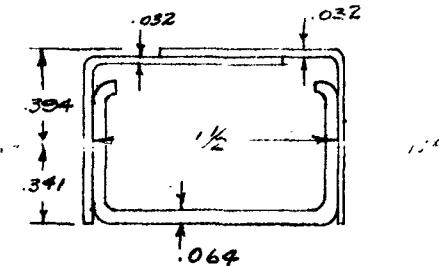
$P = +5800 \text{ #}$  (REF.: pg. 101) FOR R.G.W.(72-1000<sup>0</sup> BOMBS), FDLGE, SEA LEVEL.

AREA OF CHANNEL-TUBE END SECTION = .28500"

$$I = .0216 \text{ IN}^4$$

$$\bar{y} = .341 \text{ IN}$$

$$y_0 = .394 \text{ IN}$$



$$f_t = \frac{P}{A} + \frac{P e \frac{y_0}{I}}{I} = \frac{5800}{.28500} + \frac{(5800)(.341)^2}{.0216}$$
$$= 51,550 \text{ #}/\text{in}$$

ASSUME  $C_r = .8$  AND A RIVET CONCENTRATION FACTOR OF  $F_c = .9$

$$F_e = .8 \times .9 \times 74,000 = 53,280 \text{#/in} \text{ FOR 75ST}$$

$$M.S. = \frac{53,280}{51,550} - 1 = \boxed{+1.03}$$

RIVET ATTACHMENT OF TUBE END QR

$P_{MAX} = 8,050 \text{ #}$  (REF. PG. 127) FOR R.G.W.(72-1000<sup>0</sup> BOMBS), FDLGE, SEA LEVEL.

THE TUBE IS ATTACHED TO THE CHANNEL BY 18- 5/32 AD.RIVETS. THE RIVETS ARE CRITICAL IN SHEAR.

THE RIVET ALLOWABLE FOR 18- 5/32 RIVETS  
 $= 18 \times 596 = 10,730 \text{ #}$

$$M.S. = \frac{10730}{8050} - 1 = \boxed{+1.33}$$

ANALYSIS Wing  
PREPARED BY Canfield  
CHECKED BY Allison  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. F25-36-242  
MODEL XB-36  
DATE 11/47  
BLK HO #19

### UPPER CHORD

FROM A STUDY OF THE B-36A ANALYSIS  
(REF.: F25-36-142, pg. I-321) IT IS FOUND  
THAT THE CRITICAL STRESSES IN THE  
UPPER CHORD OCCUR AT THE REAR  
SPAR. THE CRITICAL CONDITION IS D.G.W.  
FDLGE AT SEA LEVEL AND SINCE THE CHORD  
MEMBERS ON BOTH SHIPS ARE THE  
SAME THE ANALYSIS FOR THE XB-36  
IS AS FOLLOWS:

### COMPRESSION IN LIPPED FLANGE AT REAR SPAR

$$P = -23,050 \text{ #} \quad (\text{REF.: pg. I-27})$$

$$A = 1.065 \text{ in}^2 \quad (\text{REF.: F25-36-142, pg. I-319})$$

$$f_c = \frac{P}{A} + \frac{Mc}{I} = \frac{-23050}{1.065} + 0 = 21,650 \text{ #}/\text{in}^2$$

$$f_c = 25,000 \text{ #}/\text{in}^2 \quad (\text{REF.: F25-36-142, pg. I-322})$$

$$M.S. = \frac{25000}{21650} = 1 =$$

+ .15

### LOWER CHORD

FROM A STUDY OF THE B-36A ANALYSIS  
(REF.: F25-36-142, pg. I-325) IT IS FOUND  
THAT THE R.G.W., LAR.H.S @ 5000' (12-4000#  
BOMBS), PRODUCED THE CRITICAL STRESSES  
IN THIS MEMBER WITH A M.S. = +2.20.  
SINCE THE M.S. IS HIGH AND THE LOWER CHORD  
ON BOTH AIRPLANES IS THE SAME,  
AN ANALYSIS OF THIS MEMBER IS  
CONSIDERED UNNECESSARY.

### INTERCOSTAL ANALYSIS

THE MEMBERS ON BOTH AIRPLANES ARE  
THE SAME AND THE M.S.'S ARE HIGH,  
(REF.: F25-36-142, pg. I-333) THEREFORE AN

ANALYSIS WING  
PREPARED BY Canfield  
CHECKED BY Allan  
REVISED BY \_\_\_\_\_

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MODEL XB-36  
DATE 11/47  
BLK H.O. #19

INTERCOSTAL ANALYSIS IS CONSIDERED UNNECESSARY FOR THE XB-36 AIRPLANE.  
REFER TO THE ABOVE REFERENCED REPORT FOR THE INTERCOSTAL ANALYSIS AND M.S.

### ANALYSIS OF REAR SPAR MEMBER

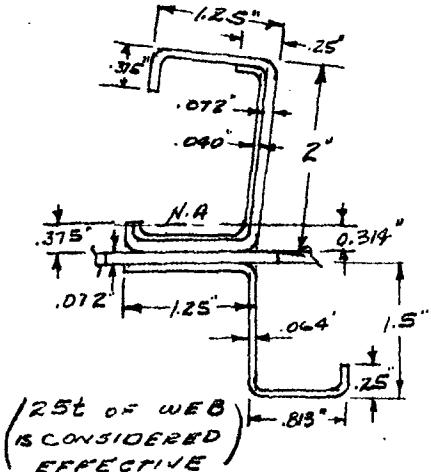
THE REAR SPAR MEMBER IS ANALYZED FOR COMBINED AXIAL AND BENDING (FUEL) STRESSES.

COND. 1, U.G.W., F.U.L.G.E., SEA LEVEL, IS THE CRITICAL COND. FOR THE DESIGN OF THIS MEMBER.

1. A CHECK IS MADE AT THE LOWER END OF THE MEMBER FOR THE COMBINATION OF THE MAXIMUM AXIAL COMPRESSIVE LOAD IN THE MEMBER COMBINED WITH BENDING FROM THE FUEL PRESSURE.

2. A CHECK IS MADE AT 57.74% OF THE MEMBER LENGTH MEASURED FROM THE UPPER END OF THE MEMBER AT WHICH POINT THE MAXIMUM BENDING MOMENT OCCURS FOR THE TRIANGULAR LOADING RESULTING FROM FUEL PRESSURE IN THE O.G.W., FOLGE@SEALEVEL, CONDITION.

### CHECK JUST ABOVE LOWER CHORD MEMBER



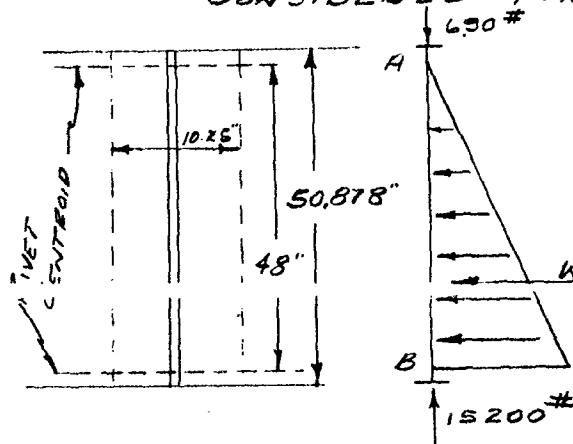
$$A = 0.8137 \text{ in}^2$$
$$I_{NA} = 0.7814 \text{ in}^4$$
$$I/C_e = \frac{0.7814}{1.806} = 0.415 \text{ in}^3$$

ANALYSIS WING  
PREPARED BY Canfield  
CHECKED BY Allan  
REVISED BY \_\_\_\_\_

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BLKHD. #19

FOR THIS CHECK THE ENDS OF THE  
MEMBER ARE CONSERVATIVELY  
CONSIDERED FIXED.



$$-\frac{N_A}{W} = -2.090 \quad 13.85 \quad (\text{REF: FES-36-126})$$

$$P_{\text{MAX}} = \frac{6}{2.31} \times 50.878 \times 2.09 \times 1.5 \\ = 4.14 \text{#/in}^2$$

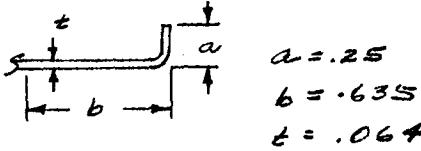
$$W = \frac{4.14(10.25)(48)}{2} = 1020 \text{#}$$

$$M_B = \frac{WL}{10} = \frac{1020 \times 48}{10} \\ = 4900 \text{ in.}\#$$

$$f_c = \frac{P}{A} + \frac{MC}{I} = \frac{15200}{0.8137} + \frac{4900}{415}$$

$$= 30,490 \text{#/in}^2$$

THE ALLOWABLE IS THAT OF THE LIPPED  
ELEMENT OF THE ZEE



$$a = .25$$

$$b = .635$$

$$t = .064$$

$$e/a = \frac{.25}{.064} = 3.91$$

$$\sqrt{e^2 + a^2} = .635$$

(REF: C.V.A.C. STRUCT. HANDBOOK #1,  
pg. 2,224)

FOR 24ST84

$$f_{c'e} = 64,000 \text{ psi}$$

$$f_{c'e} = 70,000 \text{ psi} \quad (\text{REF: C.V.A.C. STRUCT. HANDBOOK #1, pg. 2,232})$$

$$M.S. = \frac{70000}{30490} - 1 =$$

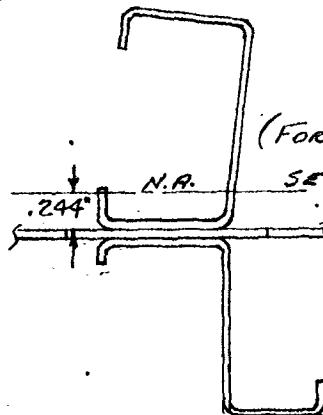
$$+1.29$$

ANALYSIS WING  
PREPARED BY Canfield  
CHECKED BY Allens  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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MODEL XB-36  
DATE 11/47  
BLKH.D.#19

SECTION AT 57.74% OF STIFFENER FROM TOP



$$A = .6857 \text{ in}^2$$

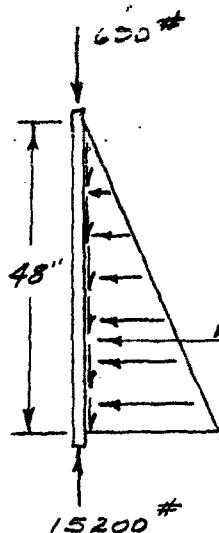
$$I_{NA} = .7101 \text{ in}^4$$

$$\frac{I}{C_e} = \frac{.7101}{1.756} = .404 \text{ in}^3$$

$$\sigma_c = 57,500 \text{#/in}^2$$

(REF: F2S-36-142, pg I-341)

FOR THIS CHECK THE ENDS OF THE MEMBER ARE CONSERVATIVELY ASSUMED SIMPLY SUPPORTED.



$$q = \frac{15200 - 600}{48} = 303 \text{#/in.}$$

$$\begin{aligned} \text{AXIAL LOAD AT } 57.74\% L \\ &= 690 + (.5774)(48)(303) \\ &= 9090 \text{#} \end{aligned}$$

$$\begin{aligned} M_{MAX} &= .128 WL = .128(1020)(48) \\ &= 6260 \text{ in} \cdot \text{ft} \end{aligned}$$

$$\begin{aligned} f_c &= \frac{P}{A} + \frac{Mc}{I} = \frac{9090}{.6857} + \frac{6260}{.404} \\ &= 13,250 + 15,500 \\ &= 28,750 \text{#/in}^2 \end{aligned}$$

$$M.S. = \frac{57,500}{28,750} - 1 =$$

+1.00

ANALYSIS WING  
PREPARED BY Myford  
CHECKED BY \_\_\_\_\_  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
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FORT WORTH, TEXAS

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REPORT NO F25-96-242  
MODEL XB-96  
DATE 5-48

WING BULKHEAD #11  
(36 W III)

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ANALYSIS WING  
PREPARED BY Lourey Jr.  
CHECKED BY Zifford  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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MODEL XB-36  
DATE 5/21/48

WING BULKHEAD #11

DISCUSSION:

BULKHEAD #11 IS LOCATED 339.5 INCHES FROM THE CENTERLINE OF THE AIRPLANE. THE PRIMARY FUNCTION OF THE BULKHEAD IS TO INTRODUCE AIR, INERTIA, AND ENGINE MOUNT FITTING LOADS INTO THE WING, RESIST CRUSHING LOADS, AND STABILIZE THE PLATE-STRINGER COMBINATIONS. IT ALSO SERVES AS THE INBOARD END OF THE CENTER FUEL TANK. IT IS OF THE WEB TYPE, CONSTRUCTED ENTIRELY OF ALUMINUM ALLOYS. THE CONDITIONS THAT HAVE BEEN DETERMINED AS CRITICAL ARE:

- (I) TWO-WHEEL LANDING, NOSE DOWN, INCLINED REACTIONS, D.G.W. (255,272<sup>#</sup>) LESS BOMBS, FULL FUEL AND OIL.
- (II) MIN. FLYING WT. (136,018<sup>#</sup>) ILAA, H.S @ 5000 FT.
- (III) SIDE DRIFT LANDING, A.G.W. (112-500<sup>#</sup> BOMBS)

THESE CONDITIONS ARE SIMILAR TO THOSE FOUND TO BE CRITICAL FOR THE XB-36A AIRPLANE (F25-36-142, PG. II-3). DUE TO THE FACT THAT DIFFERENT CRITERIA IS USED FOR DETERMINING GUST FACTORS ON THE XB-36 AIRPLANE, THE LOADING FOR CONDITION (II), SHOWN ABOVE, WILL BE HIGHER FOR THE XB-36.

ANALYSIS WING  
PREPARED BY LONGLEY  
CHECKED BY Moffett  
REVISED BY \_\_\_\_\_

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FORT WORTH, TEXAS

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DATE 5/21/48

WING BULKHEAD #11

DISCUSSION (CONT'D.)

THE ENGINE MOUNT FITTING LOADS ARE CALCULATED WITH THE AID OF THE UNIT LOAD TABLES OF REPORT NO. F25-36-243 (STRESS ANALYSIS OF ENGINE MOUNT AND NACELLE). THE LOADS IN THE EXTENSION MOUNT TRUSS MEMBERS ARE CALCULATED FOR CONDS (I) AND (II) AND ARE RESOLVED AT THE FITTING POINTS INTO VERTICAL, DRAG, AND SIDE COMPONENTS ACTING ON THE BULKHEAD FITTINGS.

THE XB-36 BULKHEAD LOADS DUE TO AIRLOADS, CRUSHING LOADS, AND FUEL LOADS FOR CONDITION (II) ARE OBTAINED FROM THE B-36A LOADS AS SHOWN ON PG. 155.

ANALYSIS WING  
PREPARED BY Voss  
CHECKED BY Tenney  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
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DATE 11-47

CALCULATION OF EFFECT OF LOAD FACTORS FOR  
CONDITIONS I AND II.

THE LOAD FACTORS ACTING ON THE ENGINE & NACELLE  
CONTENTS MUST BE RESOLVED INTO PLANES  
PERPENDICULAR & PARALLEL TO THE THRUST LINE  
TO MAKE USE OF THE UNIT LOADS. OF F2S-36-153,  
P. 137 TO 139.

CALCULATIONS FOR LOAD FACTORS  
FOR CONDITION I - DGN. (255,272") - TWO WHEEL  
LANDING - I.R.-N.D.

$$n_y = -4.00 \text{ ULTIMATE (DOWN)}$$

$$n_d = 1.32 \text{ ULTIMATE (FWD.) (REF. ANC-2)}$$

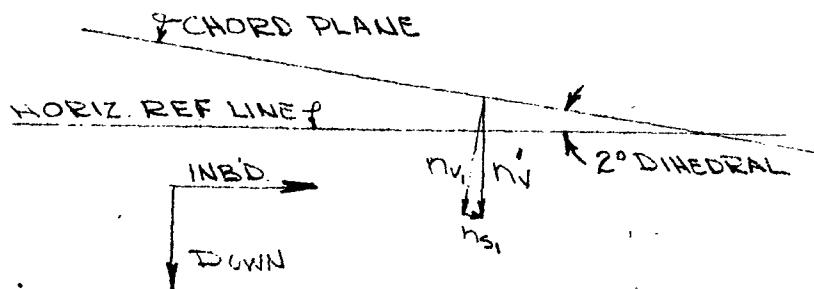
BECAUSE OF THE PITCHING ACCELERATION IN  
LANDING THE VERTICAL LOAD FACTOR IS INCREASED.

$$\frac{\alpha}{12g} = -0.006516 \quad (\text{REF. F2S-36-240 P. 174})$$

DISTANCE OF C.G. OF INBD. ENGINE AFT. OF C.G. OF  
AIRPLANE = 154.3"

$$n'_y = -4.00 + (-0.006516)(154.3) = -5.00$$

RESOLVING THE LOAD FACTORS INTO PLANES  
PERPENDICULAR & PARALLEL TO THE THRUST LINE:



ANALYSIS WING  
PREPARED BY Yoss  
CHECKED BY Sawyer  
REVISED BY

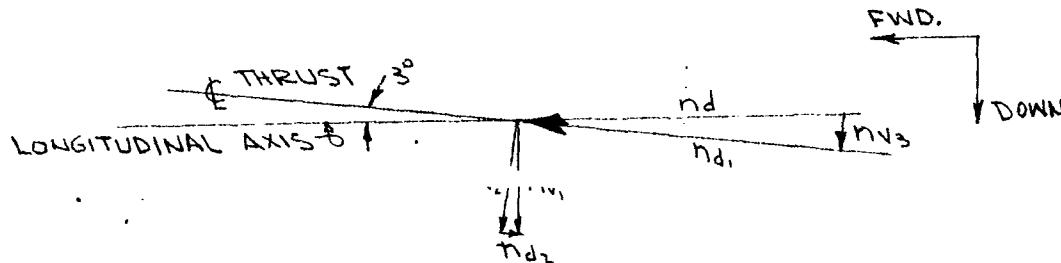
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FORT WORTH DIVISION  
FORT WORTH, TEXAS

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DATE 11-47

COND. I LOAD FACTORS CONTD.

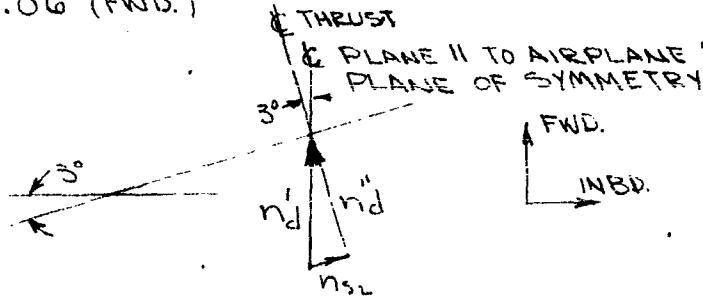
$$n_{V1} = 5.00 \cos 2^\circ = 5.00 (.99939) = 5.00 \text{ (DOWN)}$$

$$n_{S1} = 5.00 \sin 2^\circ = 5.00 (.0349) = .17 \text{ (INBD.)}$$



$$n''_V = 5.00 \cos 3^\circ + 1.32 \sin 3^\circ = 5.00 (.99863) + 1.32 (.05234) \\ = 5.06 \text{ (DOWN)}$$

$$n'_d = 1.32 \cos 3^\circ - 5.00 \sin 3^\circ = 1.32 (.99863) - 5.00 (.05234) \\ = 1.06 \text{ (FWD.)}$$



$$n''_d = 1.06 \cos 3^\circ = 1.06 (.99863) = 1.06 \text{ (FWD.)}$$

$$n''_s = n_{S1} + n_{S2} = .17 + 1.06 \sin 3^\circ = .23 \text{ (INBD.)}$$

SUMMARY OF LOAD FACTORS FOR USE IN OBTAINING  
FITTING LOADS IN THE DGW-ZWL-IR-ND CONDITION.

$$\begin{aligned} n''_V &= 5.06 \text{ (DOWN)} \\ n''_d &= 1.06 \text{ (FWD.)} \\ n''_s &= .23 \text{ (INBD.)} \end{aligned} \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} \text{ULTIMATE}$$

ANALYSIS WING  
PREPARED BY H. G. H.  
CHECKED BY J. Johnson  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
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FORT WORTH, TEXAS

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CALCULATION & RESOLUTION OF LOAD FACTORS FOR  
CONDITION II MIN. FLYING WT. = 136,018# - I.L.A.A @ 5,000'

$$-\frac{N_A}{W} = 2.236 \text{ (LIMIT)}$$

$$\frac{X_M}{W} = -.012 \text{ (LIMIT)} \quad (\text{REF. FZS-36-126-P. 84})$$

RESOLVING THE LOAD FACTORS INTO PLANES PARALLEL  
& PERPENDICULAR TO THE THRUST LINE:

$$n_V = \frac{N_A}{W} \cos 2^\circ (1.5) = 2.236 \times .99939 \times 1.5 = 3.35 \text{ (UP)}$$

$$n_d = \frac{X_M}{W} \cos 3^\circ (1.5) = -.012 \times .99863 \times 1.5 = -.018 \text{ (FWD.)}$$

$$n_s = \left( \frac{N_A}{W} \sin 2^\circ + \frac{X_M}{W} \sin 3^\circ \right) 1.5 = \left( 2.236 \times .0394 - .012 \times .0523 \right) \times 1.5 \\ = .1312 \text{ (OUTBD)}$$

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CHICAGO, ILLINOIS

EXTENSION  
MOUNT  
POINTS  
FOR FLIGHT

UNIT LOADS FROM  
BATCH POINTS

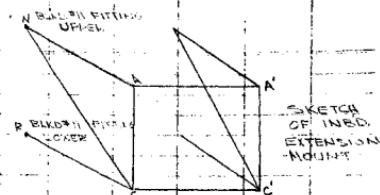
	19 DOWN	19 INBD.	19 AFT	19 DOWN	13 INBD.	19 AFT
V	2	2	2	V	5	5
D	2	3	4	D	12	12
A	10	11	11	A	18.9	18.9
K	-9.2	-9.2	-9.2	K	-18.9	-18.9
C	-1.3	-1.3	-1.3	C	-1.3	-1.3
C'	-1.3	-1.3	-1.3	C'	-1.3	-1.3

ULTIMATE LOADS APPLIED TO INBD EXTENSION MOUNT  
FOR DESIGN CONDITIONS (INERTIA, EPI CYCLE ONLY)

UNIT LOADS FROM EXTENSION MOUNT  
INTERIOR POINTS

	19 DOWN	13 INBD.	19 AFT
V	V	5	5
D	12	12	12
A	18.9	18.9	18.9
K	-18.9	-18.9	-18.9
C	-1.3	-1.3	-1.3
C'	-1.3	-1.3	-1.3

MACH 110  
FLIGHT NO F25-316-2A2  
DATE 11-17



ULTIMATE LOADS DON'T EXIST - USE FACTORS NEXT 5.06 TOWN, ERAS 1000+ FIND. PINE IS INCL IN THIS TOWN

V	D	S	N	V	D	S	N	V	D	S	N	V	D	S
5.06	1.5	1.5	1.5	5.06	1.5	1.5	1.5	5.06	1.5	1.5	1.5	5.06	1.5	1.5
S	1.5	1.5	1.5	S	1.5	1.5	1.5	S	1.5	1.5	1.5	S	1.5	1.5
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮
A	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
K	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
C	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
C'	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5

ULTIMATE LOADS DON'T EXIST - USE FACTORS NEXT 5.06 TOWN, ERAS 1000+ FIND. SIDE 1312 OUTRD. (REF. W29)

V	D	S	N	V	D	S	N	V	D	S	N	V	D	S
5.06	1.5	1.5	1.5	5.06	1.5	1.5	1.5	5.06	1.5	1.5	1.5	5.06	1.5	1.5
S	1.5	1.5	1.5	S	1.5	1.5	1.5	S	1.5	1.5	1.5	S	1.5	1.5
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮
A	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
K	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
C	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
C'	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5

SIGN CONVENTION:

- + VERTICAL LOADS DOWN
- + SIDE LOADS INBD.
- + LONG LOADS AFT

CALC PT: VOR4  
CR: BY: CONVEX

CONSOLIDATED VULTEE AIRCRAFT CORPORATION  
PORT WORTH TEXAS  
(INERTIA EFFECTS ONLY)

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FZS-36-242  
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TABLE XXXI

MEMBER MEMBER MEMBER MEMBER  
MEMBER LOAD DUE LOAD DUE LOAD DUE LOAD DUE  
TO 1000\* TO 1000\* TO 1000\* TO 1000\*  
DOWN AT N DOWN AT C AFT AT A AFT AT C

	(1)	(2)	(3)	(4)
AW	0	0	1010T	0

CW	1322T	1422T	1960C	913T
----	-------	-------	-------	------

L<sub>T</sub> 100T 100M 147M 126  
(REF. FZS-36-53 TABLE XXXI)

ULTIMATE MEMBER LOADS DGW-ZWL-IR-KD

MEMBER  $\Sigma V_A^*$  \*  $\Sigma E_D^*$   
 $1000 \times 1 \times 1000 \times 2 \times 1000 \times 3 \times 1000 \times 4$

(5)	(6)	(7)	(8)
-----	-----	-----	-----

\*REF. TABLE  
FOR ENGAGED

AW	0	0	30,600T	0
----	---	---	---------	---

CW	13,060T	12,150T	5,940C	2,790C
----	---------	---------	--------	--------

CR	9,910C	9,220C	4,560T	2,600C
----	--------	--------	--------	--------

ULTIMATE MEMBER LOADS MIN. FLYING WT. ILAA @ 5000

MEMBER  $\Sigma V_A^*$  \*  $\Sigma E_D^*$   
 $1000 \times 1 \times 1000 \times 2 \times 1000 \times 3 \times 1000 \times 4$

(9)	(10)	(11)	(12)
-----	------	------	------

AW	0	0	21,100C	0
----	---	---	---------	---

CW	8,530C	8,170C	4,100T	17,30T
----	--------	--------	--------	--------

CR	6,412C	6,620T	3,120C	17,30T
----	--------	--------	--------	--------

CALC BY: Voss  
CK BY: Johnson

CONSOLIDATED VULTEE AIRCRAFT CORPORATION  
FORT WORTH DIVISION FORT WORTH, TEXAS

FW 153 125 PAGE 11-43

SUMMARY OF SIDE LOAD  
COMPONENTS @ A, A', C & C' DUE

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TABLE XXXVII

TO 1000\* VERTICAL & 1000\* DRAG LOADS

POINT	FROM VERT. LOAD OF 1000# DOWN @ A	FROM DRAG LOAD OF 1000# DOWN @ A	FROM VERT. LOAD OF 1000# DOWN @ A'	FROM DRAG LOAD OF 1000# DOWN @ A'	FROM VERT. LOAD OF 1000# DOWN @ C	FROM DRAG LOAD OF 1000# DOWN @ C	FROM VERT. LOAD OF 1000# DOWN @ C'	FROM DRAG LOAD OF 1000# DOWN @ C'
	1	2	3	4	5	6	7	8
A		-36.8						
A'				+81.1				
C	-2.9	+4			-2.9	-34.3		
C'			-47.9	+5.55			-47.9	+120
	+ COMPONENT INBD.							

(REF FZS-36-153 TABLE XXXV)

CALC BY: NOSS  
CK. BY: *[Signature]*

UNCONSOLIDATED VULTEE AIRCRAFT CORPORATION THREE XXXII

PLACEMENT OF SIDE LOADING ON INBOARD  
ENGINE MOUNT, POINTS A, B, C & D

PAGE: 100  
REF ID: FEB-36-244  
DATE: 11-67

LONGITUDINAL  
ACCELERATION

SWING  
ROTATIONAL

LONGITUDINAL  
ACCELERATION

UNCONSOLIDATED VULTEE CORPORATION THREE XXXII  
TEST MANUFACTURED FOR ENGINE MOUNTS FOR THE PLANE

\* UNCONSOLIDATED  
ON ENGINE MOUNT POINTS A, B, C & D  
INVESTIGATION, AND TEST MANUFACTURE  
UNIT NUMBER ONE.  
(SEE LINE XXXII)

X 1000 ← WHERE ENGINE MOUNTS TO ENGINE POINT  
POINT A, B, C & D. UNIT NUMBER ONE LONG IS APPROVED.  
(SEE LINE XXXII)

ONE SIDE LOAD TEST  
ONE SIDE LOAD TEST

X 1000 ← WHERE ENGINE MOUNTS TO ENGINE POINT  
POINT A, B, C & D. UNIT LONG IS APPROVED.  
(SEE LINE XXXII)

DGW-2XL-TR-HD				MIN. FLYING WT/LAA @ 5000'			
A	B	C	C	A	B	C	C
0	0	-27	-44	0	+17	+208	
0	0	-29	-413	0	+11	+233	
-1115	+2440	+12	+61	-770	-100	-78	-118
0	0	-1045	-4490	0	-63	+1760	
-3573	+4319	+5215	-692	-775	-571	-342	+2805
0	0	+148	+2238	0	0	+148	+2238
0	0	+135	+1238	0	0	+135	+1238
-400	-1000	+459	+1010	-56	+102	-56	+102
0	0	+427X	+1874X	0	+427X	+1444X	
0	0	+1288	+1128	0	+1288	+1128	
-158	-158	+221	+221	-158	-158	-158	-158

SIGN CONVENTION  
+ SIDE LOADS INWARDS.

L - L.H. WING  
R - R.H. WING

CALC BY J.W.

J.W. Johnson

ANALYSIS WING  
PREPARED BY Yoss  
CHECKED BY Tourney  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

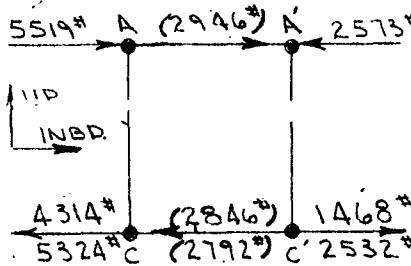
PAGE 144  
REPORT NO. FZS-36-242  
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DETERMINATION OF FLANGE LOADS IN UPPER & LOWER SHEAR BEAMS OF INBOARD EXTENSION MOUNT.

$P_F = \text{FLANGE LOAD} = \text{NET SHEAR} \times 74.5 / 48.5 \text{ FOR UPPER SURF}$   
(REF. FZS-36-153 TABLE L)  
 $74.9 / 51.5 \text{ FOR LOWER SURF}$

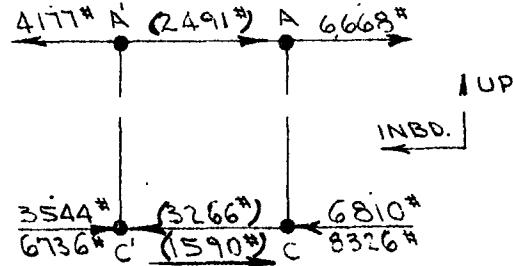
$P_T = \text{TENSION FIELD FACTOR} = \text{NET SHEAR} \times \frac{\cot \alpha}{2} \quad \cot \alpha = 1.183 \text{ FOR UPPER SURF}$   
 $\cot \alpha = 1.205 \text{ FOR LOWER SURF}$

MIN. FLYING WT - ILAA @ 5000'  
(L.H. MOUNT)

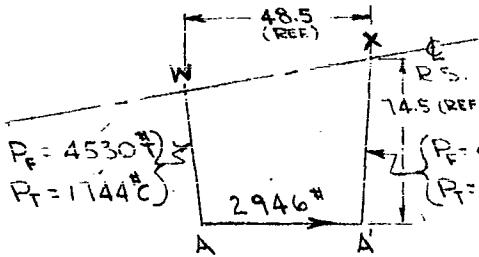


VIEW LOOKING  
FWD.

DGW-2WL-IR-ND  
(RH. MOUNT)



VIEW LOOKING  
FWD.

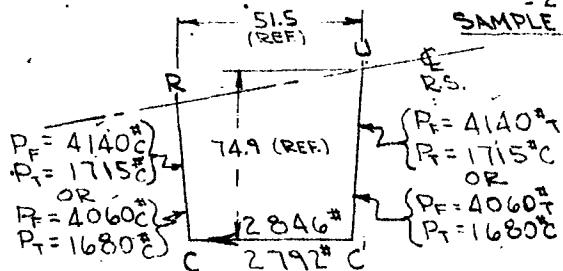


PLAN VIEW  
UPPER SURF.

$$P_F = 2946 \times \frac{74.5}{48.5} = 4530\#$$

$$P_T = 2946 \cot \alpha / 2 = 2946 \times 1.183 / 2 = 1744^{\circ}\text{C}$$

SAMPLE CALCULATION

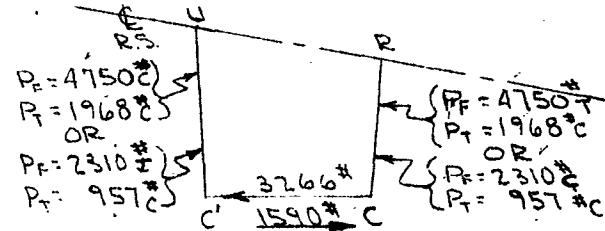


PLAN VIEW  
LOWER SURF.

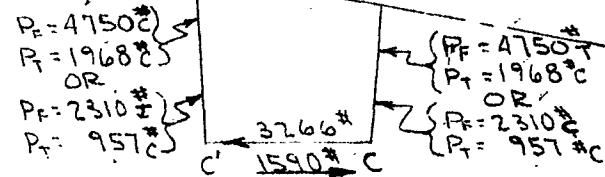
$$P_F = 2946 \times \frac{74.5}{48.5} = 4530\#$$

$$P_T = 2946 \cot \alpha / 2 = 2946 \times 1.183 / 2 = 1744^{\circ}\text{C}$$

SAMPLE CALCULATION



PLAN VIEW  
UPPER SURF.



PLAN VIEW  
LOWER SURF.

FIG. 13

**CONSOLIDATED VULTEE AIRCRAFT CORPORATION** TABLE ~~XXXX~~ SUMMARY  
FORT WORTH DIVISION FORT WORTH, TEXAS OF EXTENSION MT. MEMBER LOADS  
PW 633 125 PADS 11-43

PAGE: 145  
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DATE: 11-47

CONDITION MEMBER	INERTIA LOADS	THRUST LOADS	TORQUE LOADS	FLANGE LOADS	V. COT *	TOTAL	
						(1)	(2)
TABLE XXXI (REF. F28-36253)					FIG. 13	FIG. 13	20125 + 29 + 15
DGW-2WL-IR-ND	AW	30,600T	1145C	12,550T	3,820C	—	38,185T
CW	13,060T	91T	6790T				
	12,150T	223T	2,440C				
	5000T	92C	5,750T				
	27900	147C	1,137C				
$\Sigma$ CW	16,480T	69T	8,963T			25,512T	
CR	9,410C	69C	5,150C				
	6,200C	169C	1,855T				
	4,560T	75T	4,360C				
	28,600	1500C	11,650C				
$\Sigma$ CR	43,170C	1663C	19,305C	2310C	957C	67,405C	
MIX FLYING WT. - ILAR @ 5000	AW	21,100C	1145C	12,550C	4,530T	17,44C	32,009C
CW	8,520C	91T	6790C				
	8,170C	223T	2,440T				
	4,103T	93C	5,750C				
	17,30T	147C	1,137T				
$\Sigma$ CW	10,870C	69T	8,963C			19,764C	
CR	6,470T	69C	5,150T				
	6,200T	169C	1,855C				
	3,120C	75T	4,360T				
	17,730T	1500C	11,650T				
$\Sigma$ CR	27,280T	1663C	19,305T	10,600C	—	40,862T	

\* LOAD DUE TO  $\frac{V C O F X}{2}$  ARE USED  
ONLY IF THEY INCREASE MEMBER LOAD

CALC. BY: lose  
EX. BY Lourey

ANALYSIS WING III

PREPARED BY TossCHECKED BY Louray

REVISED BY

## Consolidated Vallee Aircraft Corporation

FORT WORTH DIVISION

FORT WORTH, TEXAS

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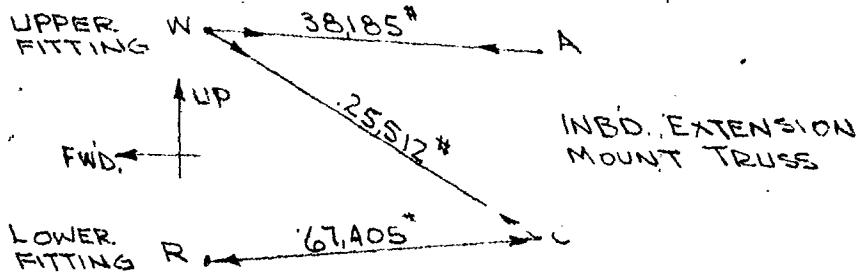
REPORT NO. F25-36-242

MODEL XB-36

DATE 4-2-48

CONDITION I D.G.W. = 255,272# - (LESS BOMBS)  
FULL FUEL & OIL - 2 WL-IR-ND

ENGINE MOUNT FITTING LOADS (REF. PG. 145.)



MEMBER	LOAD #	(REF. F25-36-153 P. 130) DIRECTION COSINE			UPPER FITTING (POINT W)		
		X	D	S	V <sub>w</sub> = ③ × ②	D <sub>w</sub> = ④ × ②	S <sub>w</sub> = ⑤ × ②
AW	38,185(T)	.1367	.9900	.0364	5,210	37,800	1,390
CW	25,512(T)	.6560	.7560	.0218	16,740	19,300	710
CR	67,405(S)	.0640	.9970	.0340			
		$\Sigma V_w = 21,950^*$ (DOWN)			$\Sigma D_w = 57,100^*$ (AFT)		$\Sigma S_w = 2,100^*$

MEMBER	LOWER FITTING (POINT R)		
	V <sub>r</sub> = ③ × ②	D <sub>r</sub> = ④ × ②	S <sub>r</sub> = ⑤ × ②
AW			
CW			
CR	4300	67,000	2,290
	$\Sigma V_r = 4,300^*$ (DOWN)	$\Sigma D_r = 67,000^*$ (FWD.)	$\Sigma S_r = 2,290^*$ (OUTBD.)

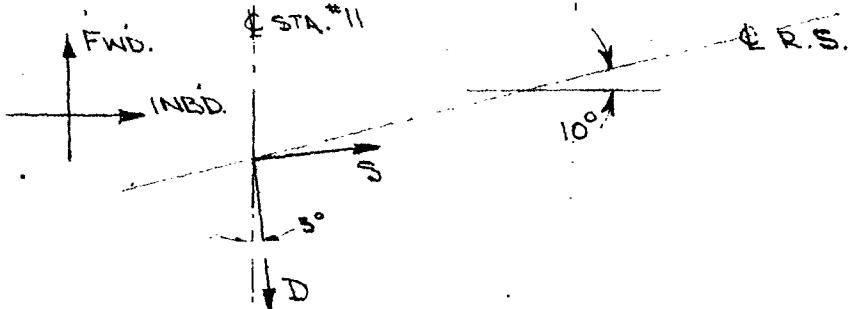
ANALYSIS WING III  
PREPARED BY VOLK  
CHECKED BY Jewell  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. FES-36-242  
MODEL XB-36  
DATE 4-5-48

### COND'D GW-2WL-IR-ND

THE DRAG & SIDE LOADS ARE RESOLVED INTO THE PLANE OF THE TULKHEAU & THE PLANE OF THE REAR SPAR.



### UPPER FITTING

$$D' = D \cos 3^\circ - S \sin 3^\circ = 57,100 \times .999 - 2100 \times .052 = 56,900^* \text{ (AFT.)}$$

$$S' = D \sin 3^\circ + S \cos 3^\circ = 57,100 \times .052 + 2100 \times .999 = 5,070^* \text{ (INBD.)}$$

$$D'' = S' \tan 10^\circ = 5,070 \times .176 = 890^* \text{ (FWL.)}$$

$$D_{\text{TOTAL}} = D' + D'' = 56,900 - 890 = 56,010^* \text{ (AFT.)}$$

### LOWER FITTING

$$D' = D \cos 3^\circ - S \sin 3^\circ = 67,000 \times .999 - 2290 \times .052 = 66,880^* \text{ (FWD.)}$$

$$S' = D \sin 3^\circ + S \cos 3^\circ = 67,000 \times .052 + 2290 \times .999 = 5,770^* \text{ (OUTBOARD)}$$

$$D'' = S' \tan 10^\circ = 5770 \times .176 = 1020^* \text{ (AFT.)}$$

$$D_{\text{TOTAL}} = 66,880 - 1020 = 65,860^* \text{ (FWD.)}$$

ADDITIONAL VERTICAL & DRAG LOADS MUST BE INCLUDED AT POINTS W & R DUE TO INERTIA ITEMS OF THE EXTENSION MOUNT BEAMED TO THESE POINTS.

### POINT W

$$V = 85^* \text{ (DOWN)} \\ D = 17^* \text{ (FWL.)} \quad (\text{REF. FES-36-142 P. II-13})$$

### POINT R

$$V = 111^* \text{ (DOWN)} \\ D = 24^* \text{ (FWL.)}$$

NOTE: B-36A LOADS FROM INERTIA ITEMS ARE USED IN PLACE OF XB-36 LOADS, SINCE THE LATTER ARE UNAVAILABLE AT THIS TIME. THIS IS DONE WITH NEGLIGIBLE ERROR AS THIS ASSUMPTION HAS ONLY A SLIGHT EFFECT ON THE NET ULTIMATE FITTING LOADS.

ANALYSIS WING III  
PREPARED BY JOM  
CHECKED BY Sourey  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. FZS-36-242  
MODEL XB-36  
DATE 4-6-48

COND ID GW-2WL-IR-ND

SUMMARY OF FITTING LOADS

UPPER FITTING

$$V = 21,450 + 85 = 22,035 \text{ # (DOWN)}$$
$$D = 56,010 - 17 = 55,993 \text{ # (AFT.)}$$

LOWER FITTING

$$V = 4,300 + 111 = 4,411 \text{ # (DOWN)}$$
$$D = 65,860 + 74 = 65,884 \text{ # (FWD.)}$$

FUEL LOADS

THE CENTER FUEL TANK IS FULL OF FUEL  
FOR THIS CONDITION.

1g FUEL LOAD AT RLKHG. #11 = 3008.2 #

C.G. FUEL IS 54.81" AFT. OF F.S. (REF. FZS-36-240 P. 13 & P. 52)

THE VERTICAL LOAD FACTOR AT THE FUEL C.G. IS:

$$M_V = -4.00 - .006516 \times (-44.86) = -3.708$$

(SEE ANGZ & FZS-36-240 P. 174)

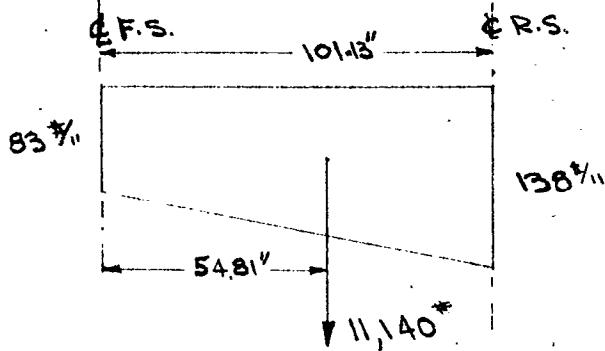
WHERE -44.86" IS THE DISTANCE OF THE FUEL C.G.

FWD. OF THE AIRPLANE C.G. (REF. FZS-36-237 P. 14 & 31)

THE ULTIMATE FUEL LOAD IS:

$$P_{ULT} = 3,008.2 \times 3.708 = 11,140 \text{ #}$$

THE FUEL IS ASSUMED DISTRIBUTED AS A TRAPEZOID



ANALYSIS WING III  
PREPARED BY W.M.  
CHECKED BY Lorrey  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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DATE 4-6-48

COND:I-DGW-2WL-IR-ND

CRUSHING LOAD

$$P_{(CRUSHING)} = \frac{(M_x)^2}{(\frac{I}{q})_x EI} L$$

$$M_x = -71.48 \times 10^6 \text{ (REF F2S-36-240 P. 219)}$$

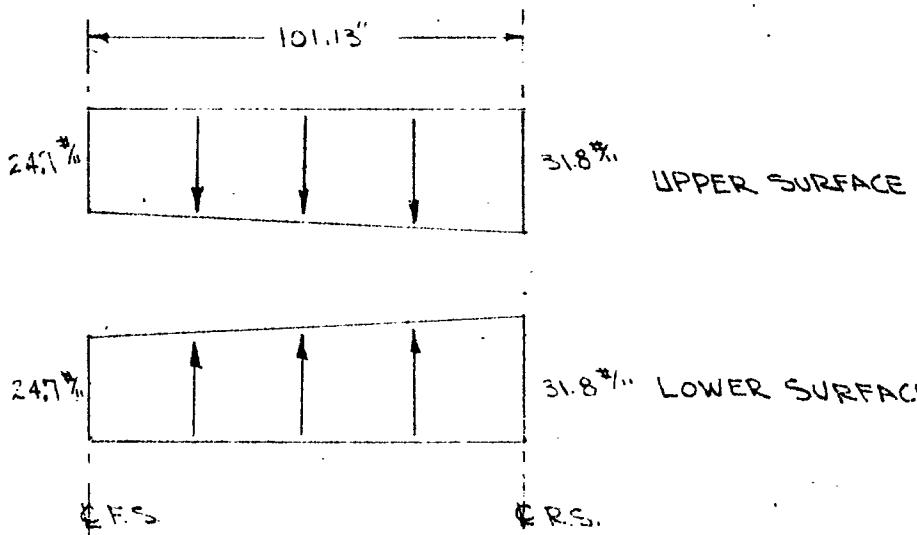
$$I_x = 86,385 \text{ (REF F2S-36-141 P. 54)}$$

$$Q_x = 1,338 \text{ (REF F2S-36-141 P. 144)}$$

$$L = \frac{36.5 + 27.5}{2} = 32.0$$

$$P_{(CRUSHING)} = \frac{(-71.48 \times 10^6)^2 (32.0)}{\left(\frac{86,385}{1,338}\right) (10.3 \times 10^6) (86,385)} = 11.13''$$

THE CRUSHING LOAD IS APPLIED SYMMETRICALLY  
TO THE UPPER & LOWER SURFACE OF THE  
BULKHEAD & THE DISTRIBUTION IS ASSUMED  
TO BE TRAPEZOIDAL WITH THE MAGNITUDE  
OF THE BASES PROPORTIONAL TO THE SPAR  
DEPTHS.



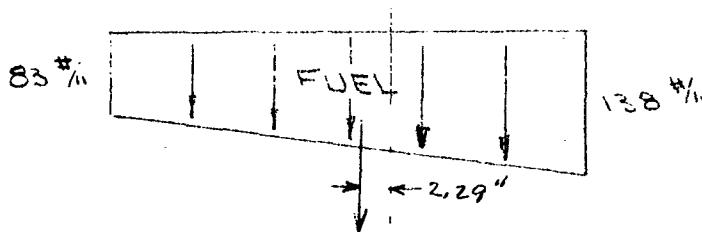
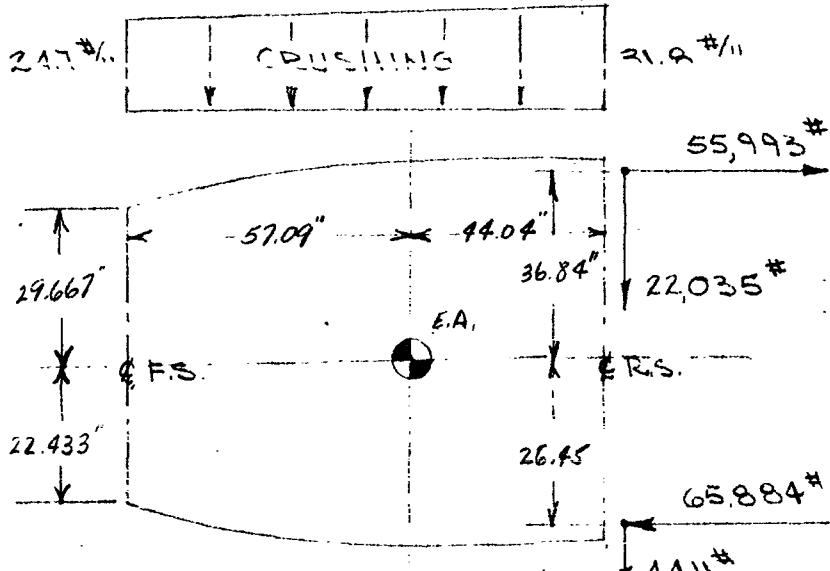
ANALYSIS WING III  
PREPARED BY Hess  
CHECKED BY Jones  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. FZS-36-242  
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DATE 4-6-48

COND:I DGW-2WL-IR-ND

APPLIED LOADS ON THE BULKHEAD



ANALYSIS WING  
PREPARED BY Yoss  
CHECKED BY Enney  
REVISED BY \_\_\_\_\_

Consolidated Valves Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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DATE 4-6-48

COND: I DGW-ZWL-IR-ND

TRANSFERRING LOADS TO THE ELASTIC AXIS OF THE BULKHEAD:

$$D = +55,993 - 65,884 = -9,891 \text{ # (FWU)}$$

$$V = 22,035 + 4,411 + 11,140 = -27,586 \text{ # (DOWN)}$$

$$\begin{aligned} T_EA = & 22,035 \times 44.04 + 4,411 \times 44.04 + 55,993 \times 36.84 \\ & + 65,884 \times 26.45 - 11,140 \times 2.29 = 49,44,590 \text{ # } \end{aligned}$$

REACTING THE DRAG LOAD AT THE UPPER & LOWER

SURFACES: REF. F25-36-142, P. II-3

$$R_U = 9891 \times \frac{32.44}{73.92} = 4,350 \text{ # (AFT.)}$$

$$R_L = 9891 \times \frac{41.48}{73.92} = 5,550 \text{ # (AFT.)}$$

REACTING R\_U & R\_L AS SHEAR FLOWS IN THE UPPER  
& LOWER SURFACES: REF. F25-36-142, P.II-3

$$q_U = \frac{4350}{101.13} = 43 \text{ #/in}$$

$$q_L = \frac{5550}{101.13} = 55 \text{ #/in}$$

THE NET VERTICAL COMPONENT DUE TO SHEAR  
FLOW IS  $= 43 \times 107.14 - 55 \times 4.534 = 212 \text{ # (UP)}$ .  
& IS REACTED AT THE FRONT & REAR SPARS.

$$P_{F.S.} = 212 \times \frac{44.04}{101.13} = 92 \text{ # (DOWN)}$$

$$P_{R.S.} = 212 \times \frac{57.09}{101.13} = 120 \text{ # (DOWN)}$$

THE VERTICAL SHEAR LOAD ON THE BULKHEAD  
IS REACTED AT THE FRONT & REAR SPARS.

$$P_{F.S.} = 27,586 \times \frac{44.04}{101.13} = 16,350 \text{ # (UP)}$$

$$P_{R.S.} = 27,586 \times \frac{57.09}{101.13} = 21,200 \text{ # (UP)}$$

ANALYSIS WING III  
PREPARED BY T. G. M.  
CHECKED BY Levrey  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

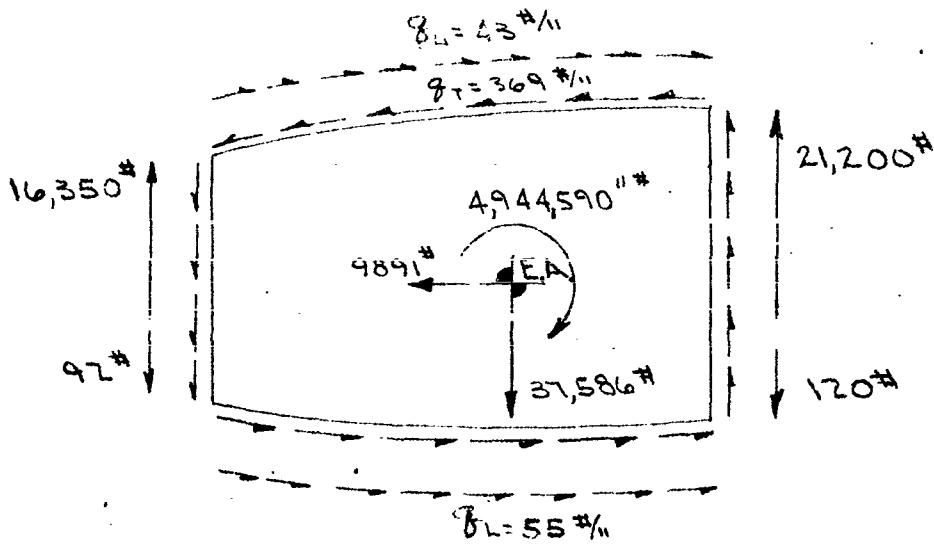
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COND: I DGN-2WL-LR-ND

TRANSFERR OF LOADS TO E.A. CONTD.

THE TORSION ABOUT THE ELASTIC AXIS (EA) IS  
REACTIONED BY A SHEAR FLOW AROUND THE  
ENTIRE BULKHEAD:

$$q_T = \frac{T_{EA}}{2A} = \frac{4944.590}{2 \times 6699} = 369 \text{#/in}$$



CONSOLIDATED VULTEE AIRCRAFT CORPORATION  
FORT WORTH DIVISION FORT WORTH, TEXAS

PW 633 125 PADS 11-43

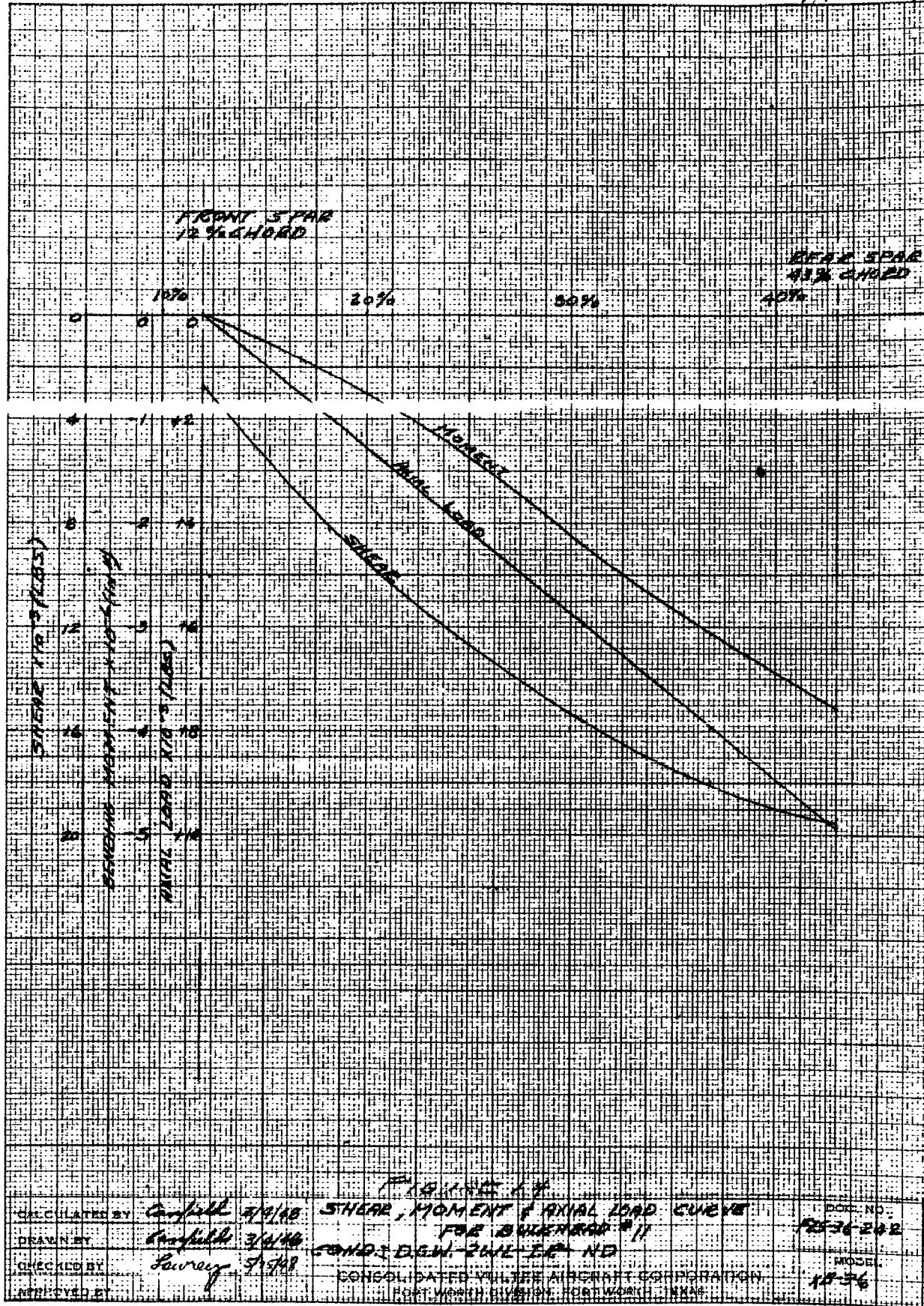
X154

11-43

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Tracy Sheet

MILITARY AIRCRAFT CO., INC., NO. 2525  
Milwaukee, Wisconsin, U.S.A.



ANALYSIS WING III  
PREPARED BY J. O. M.  
CHECKED BY Lawrey  
REVISED BY

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FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. FZS-32-242  
MODEL XB-36  
DATE 4-7-48

CONDITION: II MINIMUM FLYING WEIGHT = 136,018# - I.L.A.A (H.S.) @ 5000

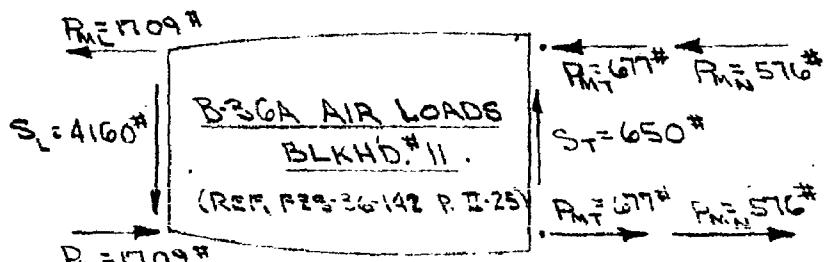
AIR LOADS

AIR LOADS FOR THE XB-36 AIRPLANE WERE  
OBTAINED FROM B-36A AIR LOADS BY ASSUMING  
THE SAME DISTRIBUTION IN THE MANNER SHOWN  
BELOW:

$$\frac{Z}{W} (\text{XB-36}) = -2.043 \quad (\text{REF. FZS-36-126 P. 40})$$

$$\frac{Z}{W} \approx -1.494 \quad (\text{REF. FZS-36-126 P. 40})$$

$$\frac{-2.043}{-1.494} \times 29.9 = 40.9 \text{#/ft} \quad (\text{SINCE } W \text{ FOR THE XB-36 AND } B-36A \text{ IS ALMOST THE SAME, THIS RATIO WILL BE USED.})$$

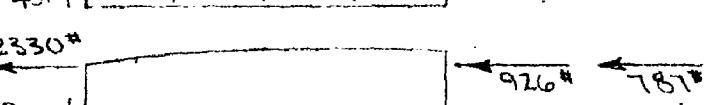


AIR LOAD DESIGNATIONS

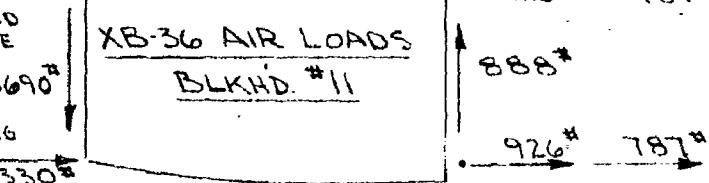
P<sub>ML</sub> = FLANGE COUPLE LOAD  
FROM LEADING EDGE  
MOMENT.



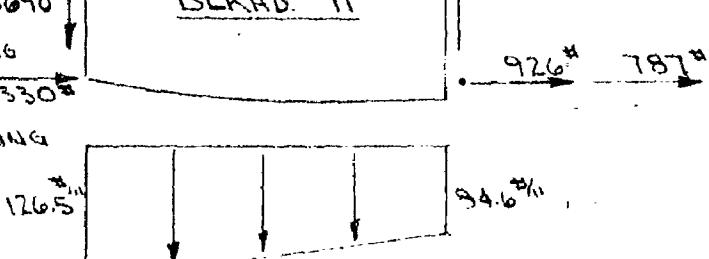
P<sub>MN</sub> = FITTING COUPLE LOAD  
FROM NACELLE  
MOMENT.



P<sub>MT</sub> = FITTING COUPLE LOAD  
FROM TRAILING EDGE  
MOMENT.



S<sub>L</sub> = SHEAR AT FRONT  
SPAR FROM LEADING  
EDGE.



S<sub>T</sub> = SHEAR AT REAR  
SPAR FROM TRAILING  
EDGE.

ANALYSIS WING II  
PREPARED BY JOSL  
CHECKED BY Levey  
REVISED BY

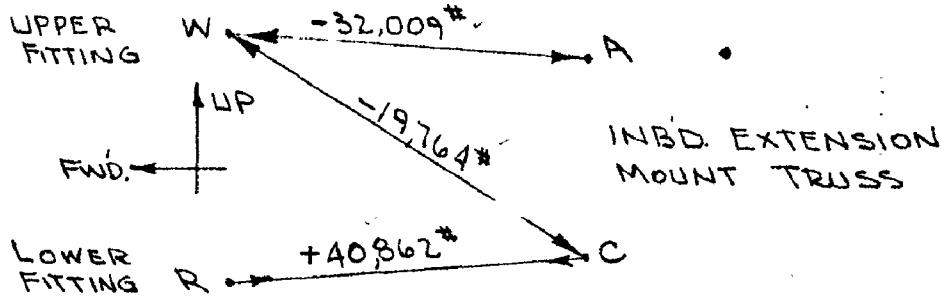
Consolidated Vultee Aircraft Corporation

FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. FZS-36-242  
MODEL XB-36  
DATE 4-8-48

CONDITION: II MINIMUM FLYING WEIGHT = 136,018# ILAA(H.S) @ 5000'

ENGINE MOUNT FITTING LOADS



MEMBER	LOAD #	DIRECTION COSINE (REF FZS-36-153 P.130)			UPPER FITTING (POINT W)		
		V/L	D/L	S/L	V <sub>w</sub> = ③ × ②	D <sub>w</sub> = ④ × ②	S <sub>w</sub> = ⑤ × ②
AW	32,009(C)	.1367	.9900	.0364	4,310	31,700	1,70
CW	19,764(C)	.6560	.7560	.0278	12,970	14,950	550
CR	40,862(J)	.0640	.9970	.0340	- - -	- - -	- - -
					$\Sigma V_w = 17340^*$ (UP)	$\Sigma D_w = 46650^*$ (FWD)	$\Sigma S_w = 1720^*$ (OUTBD)

MEMBER	LOWER FITTING (POINT R)		
	V <sub>R</sub> = ③ × ②	D <sub>R</sub> = ④ × ②	S <sub>R</sub> = ⑤ × ②
AW	- - -	- - -	- - -
CW	- - -	- - -	- - -
CR	2,620	40,700	1,390
	$\Sigma V_R = 2,620^*$ (UP)	$\Sigma D_R = 40,700^*$ (AFT.)	$\Sigma S_R = 1,390^*$ (INBD)

TOTAL OF VERTICAL LOAD

UPPER FITTING (POINT W)  
 $V_w = 17340 + 42 = 17382$  (UP)

LOWER FITTING (POINT R)  
 $V_R = 2,620 + 59 = 2,679$  (UP)

(FOR  $\Delta V_w = 42^*$  &  $\Delta V_R = 59^*$   
SEE P/157)

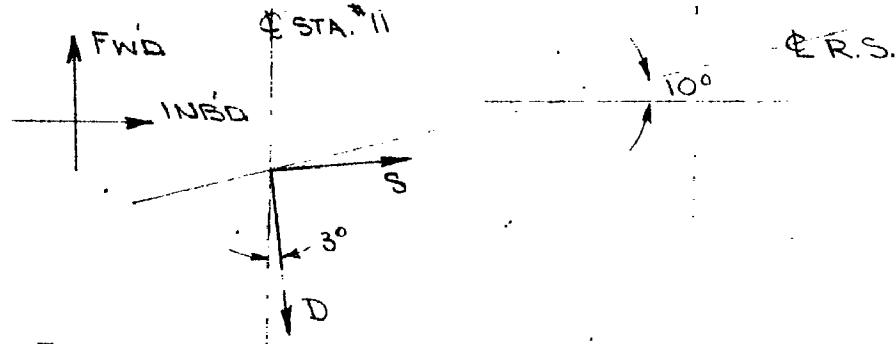
ANALYSIS WING III  
PREPARED BY UOM  
CHECKED BY Leary  
REVISED BY

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FORT WORTH, TEXAS

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REPORT NO. FES-36-242  
MODEL XB-36  
DATE 4-8-48

COND: II MFN-ILAA (H.S) @ 5000.

THE DRAG & SIDE LOADS ARE RESOLVED INTO THE PLANE OF THE BULKHEAD & THE PLANE OF THE REAR SPAR.



UPPER FITTING

$$D' = D \cos 30^\circ - S \sin 30^\circ = 46,650 \times .999 - 1720 \times .052 = 46,510^* \text{ (FWD)}$$
$$S' = D \sin 30^\circ + S \cos 30^\circ = 46,650 \times .052 + 1720 \times .999 = 4,150^* \text{ (OUTBO)}$$
$$D'' = S \tan 10^\circ = 4,150 \times .176 = 730^* \text{ (AFT.)}$$
$$D_{\text{TOTAL}} = D' + D'' = 46,510 - 730 = 45,780^* \text{ (FWD)}$$

LOWER FITTING

$$D' = D \cos 30^\circ - S \sin 30^\circ = 40,700 \times .999 - 1390 \times .052 = 40,630^* \text{ (AFT.)}$$
$$S' = D \sin 30^\circ + S \cos 30^\circ = 40,700 \times .052 + 1390 \times .999 = 3,510^* \text{ (INBO)}$$
$$D'' = S \tan 10^\circ = 3,510 \times .176 = 620^* \text{ (FWD.)}$$
$$D_{\text{TOTAL}} = 40,630 - 620 = 40,000^* \text{ (AFT.)}$$

ADDITIONAL VERTICAL & DRAG LOADS MUST BE INCLUDED AT POINTS W & R DUE TO INERTIA ITEMS OF THE EXTENSION MOUNT BEAMED TO THESE POINTS.

POINT W

$$V = 42^* \text{ (UP)} \quad (\text{REF. FES-36-142 P.D-25})$$

POINT R

$$V = 59^* \text{ (UP)}$$

THE ADDITIONAL DRAG LOADS ARE NEGLIGIBLE

NOTE: B-36A LOADS FROM INERTIA ITEMS ARE USED IN PLACE OF XB-36 LOADS, SINCE THE LATTER ARE UNAVAILABLE AT THIS TIME. THIS IS DONE WITH NEGLIGIBLE ERROR, AS THIS ASSUMPTION HAS ONLY A SLIGHT EFFECT ON THE NET. ULTIMATE FITTING LOADS.

ANALYSIS WING II  
PREPARED BY JOSL  
CHECKED BY Townley  
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MODEL XB-36  
DATE 4-8-48

CONDITION: II MINIMUM FLYING WEIGHT = 136,018# ILAA (H.S.) @ 5000'

### CRUSHING LOADS

$M_x$  FOR THIS CONDITION IS NOT CONTAINED IN ANY REPORT;  $M_x$  HAS BEEN CALCULATED INDEPENDENTLY & IS CONSIDERED SUFFICIENTLY CLOSE TO  $M_x'$  FOR USE.

$$M_x \sim M_x' = 115 \times 10^6 \text{ lb-in}$$

$$I_x = 86,385 \text{ in}^4 \quad (\text{REF. FZS-36-141 P.54})$$

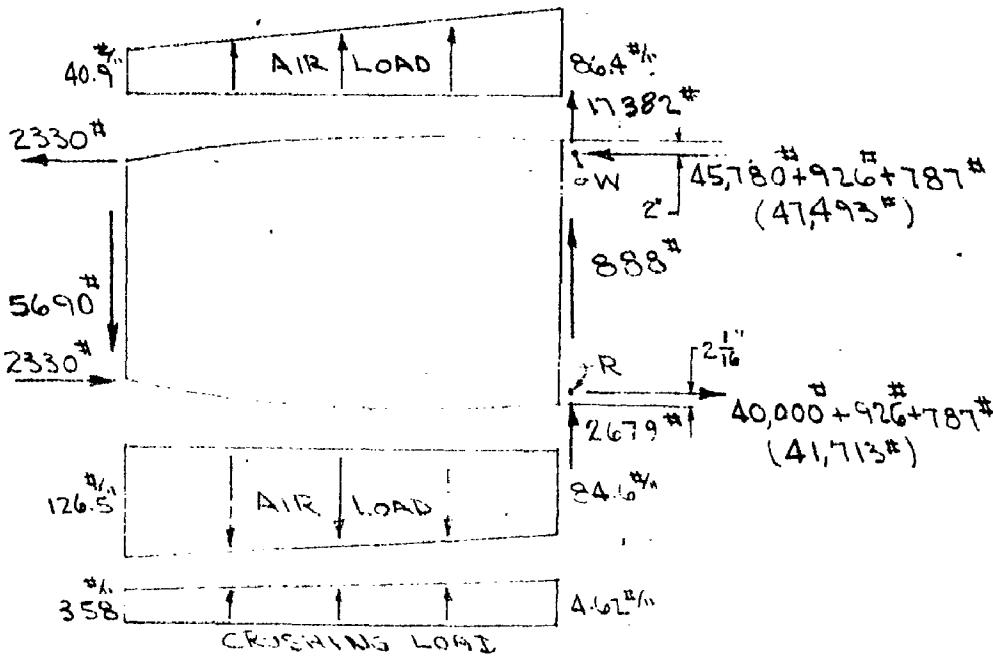
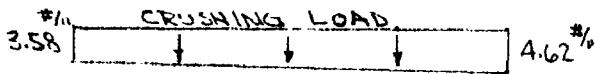
$$Q_x = 1338 \text{ in}^3 \quad (\text{REF. FZS-36-141 P.144})$$

$$L = 32.0 \text{ in}$$

$$P_{(\text{CRUSHING})} = \frac{(27.5 \times 10^6)^2 \times 32.0}{86,385 \times 10.5 \times 10^6 \times 86,385} = 414 \text{ lb}$$

THE DISTRIBUTION IS TAKEN AS A TRAPEZOID WITH THE BASES EQUAL TO 3.58#/in AT THE FRONT SPAR & 4.62#/in AT THE REAR SPAR.

### APPLIED LOADS ON THE BULKHEAD



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MODEL XB-36  
DATE 4-9-48

COND: II MFN-ILAA (H.S.) @ 5000'

TRANSFERRING LOADS TO THE ELASTIC AXIS OF THE  
BULKHEAD:

$$D = -45,780 + 40,000 = -5780 \text{ # (FWD)}$$

$$V = 5690 + 10,670 - 17,332 - 888 - 2679 - 6430 = -11,019 \text{ (UP)}$$

$$TEA = (6430 \times .49) - (2330 \times 52.1) - (5690 \times 57.09) - (17,382 + 888)$$

$$+ 2679) \times 44.04 - (926 + 787) \times 63.285 - (45,780 \times 36.84)$$

$$- (10,000 \times 26.45) - (10,670 \times 9.59) = -4,318,000 \text{ #}$$

(COUNTERCLOCKWISE)

REACTING THE DRAG LOAD AT THE UPPER & LOWER  
SURFACE SHEAR CENTERS: *REF. FZS-36-142, P. II-3*  
*FOR DIMENSIONS.*

$$R_U = 5780 \cdot \frac{32.44}{73.92} = 2540 \text{ #}$$

$$R_L = 5780 \cdot \frac{41.48}{73.92} = 3240 \text{ #}$$

REACTING R\_U & R\_L AS SHEAR FLOWS IN THE  
UPPER & LOWER SURFACES:

$$q_U = \frac{2540}{101.13} = 25.1 \text{ #/in}$$

$$q_L = \frac{3240}{101.13} = 32.1 \text{ #/in}$$

THE VERTICAL COMPONENT OF UPPER & LOWER  
SURFACE SHEAR IS:

$$R_{VU} = 25.1 \times 10.714 = 269 \text{ # (UP)}$$

$$R_{VL} = 32.1 \times 4.554 = 145 \text{ # (DOWN)}$$

THE NET VERTICAL COMPONENT IS 124# (UP) & IS  
REACTION AT THE FRONT & REAR SPARS:

$$P_{FS} = 54 \text{ # (DOWN)}$$

$$P_{RS} = 70 \text{ # (DOWN)}$$

ANALYSIS WING II  
PREPARED BY T. OSL  
CHECKED BY Lawry  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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MODEL XB-36  
DATE 4-9-48

COND: II MFW-ILAA (H.S) @ 5000'

THE VERTICAL SHEAR LOAD ON THE BULKHEAD  
IS REACTED AT THE FRONT & REAR SPARS:

$$R_{FS} = 11,019 \frac{14.04}{101.13} = 4,780\text{# (DOWN)}$$

$$R_{RS} = 11,019 \frac{57.09}{101.13} = 6,200\text{# (DOWN)}$$

THE TORSION ABOUT THE ELASTIC AXIS (T.E.A.) IS  
REACTED BY A SHEAR FLOW AROUND THE  
ENTIRE BULKHEAD:

$$q_0 = \frac{T}{2A} = \frac{4,318,000}{2 \times 6699} = 323\text{#/in}$$

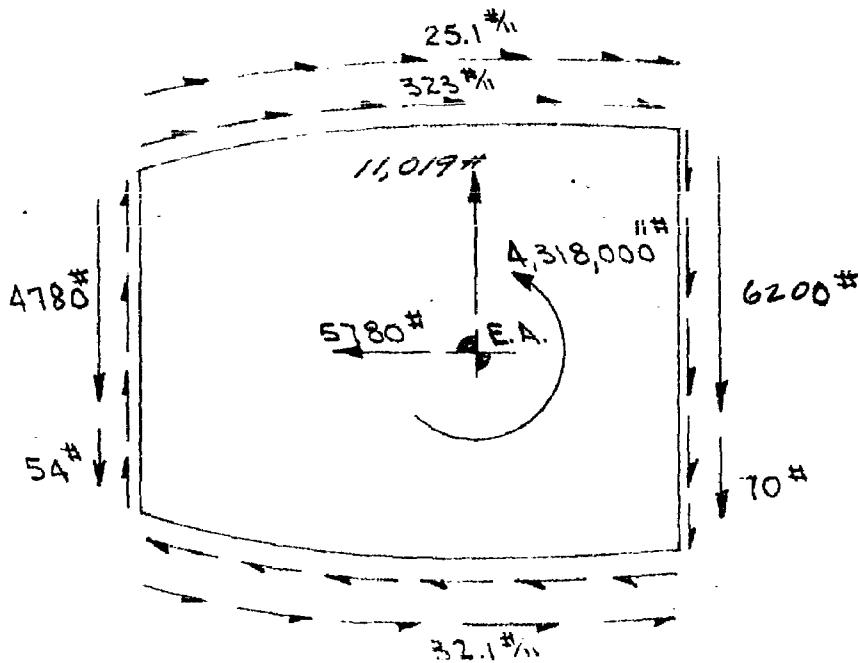
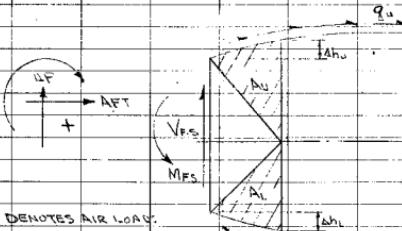


TABLE  
XXXVI

SUMMATION OF DRA & VERTICAL FORCES & MOMENTS OVER INTERVALS PAR  
AREA OF BULKHEAD AT STA #11 COND II MFW=13,618 ILB A.S. (4.5) @ 5000

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\* SUBSCRIPT "a" DENOTES AIR LOAD.  
"f" DENOTES FUEL LOADS

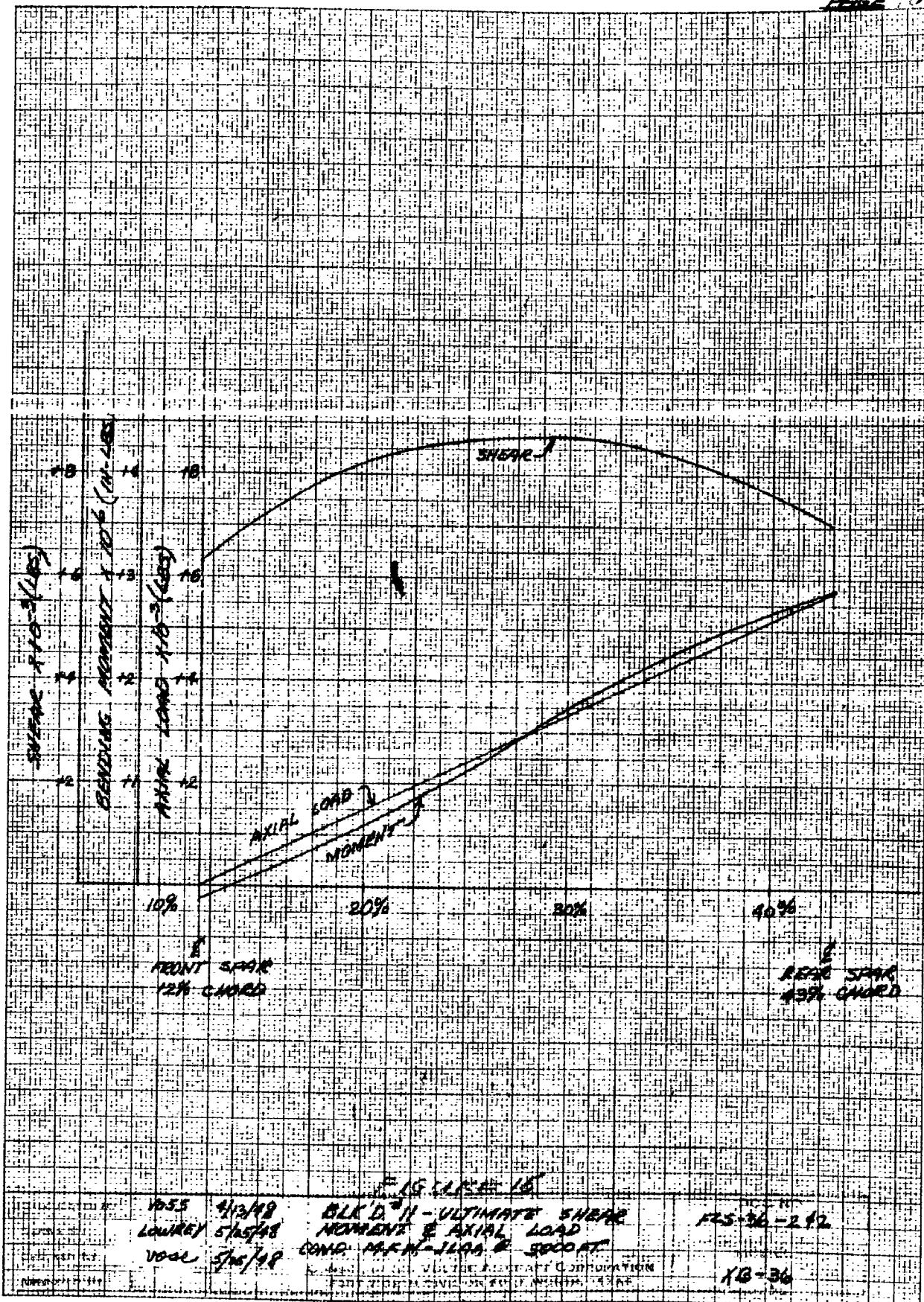
$$\text{MOMENT AT FRONT SPAN. } (M_{F.S.}) = 2330 \times 521 = 121,500"$$

### VERTICAL LOAD AT FRONT SPAN (VFS.)

$$= -5690 - 4770 - 5.1 + (-23 \times 54.1) = +6306 \text{ (UP)}$$

CALC. BY: Uose  
CKD. BY: Louray 5/21/93

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ANALYSIS WING III  
PREPARED BY Joss  
CHECKED BY Lacalle  
REVISED BY \_\_\_\_\_

## Consolidated Vultee Aircraft Corporation

FORT WORTH DIVISION  
FORT WORTH, TEXASPAGE 163  
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DATE 4-13-48

## ANALYSIS OF MEMBERS

## WEB ANALYSIS

THE MAXIMUM SHEAR OCCURS IN CONDITION I  
IN THE PORTION OF THE WEB ADJACENT TO THE  
REAR SPAR. THIS IS THE -8 WEB.

$$T = \frac{S}{ht}$$

$$S = 19,392^*$$

$$h' = 16.47" \text{ (REF FZS-36-142 P.II-31)}$$

$$t = .032"$$

$$T = \frac{19,392}{66.47 \times .032} = 9,120^{*/in}$$

$$T_{su} = 21,000^{*/in} \text{ (REF. FZS-36-142 P.II-32)}$$

$$M.S. = \frac{21,000}{9,120} - 1 = +1.30$$

## FLANGE ANALYSIS

## COMPRESSIVE STRESS IN THE LOWER FLANGE:

$$M = -3790,000^{**} \text{ (COND: DWN 2WL-IP-NV)}$$

$$h' = 66.74" * \quad *(\text{REF. FZS-36-142 P.II-34})$$

$$S_a = 19,392$$

$$h = 56" *$$

$$I = 6721 \text{ IN.}^4 *$$

$$Q = 100.8 \text{ IN.}^4 *$$

$$S_{cr} = 3140^* *$$

$$P_c = \frac{M}{h} + \frac{S_{tu} C_{stx}}{2} \text{ (REF. AAF TR #4313, P. 257 EQ. II-38)}$$

$$S_{tu} = \frac{S_a}{K_g} - S_{cr}; \quad K_g = \frac{I}{Q h} = \frac{6721}{100.8 \times 56} = 1.191$$

$$S_{tu} = \frac{19,392}{1.191} - 3140 = 13,160^*$$

$$P_c = \frac{3790,000}{66.74} + \frac{13,160}{2} - (1,086)$$

$$P_c = 63,940^*$$

ANALYSIS WING III  
PREPARED BY JDM  
CHECKED BY Louray  
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THE AXIAL LOAD ON THE BULKHEAD IS BEAMED TO  
THE FLANGE CENTROIDS:

$$P'_c = 9890 \times \frac{39.651}{66.738} = 5,880^*$$

TOTAL COMPRESSIVE STRESS IN THE LOWER FLANGE:

$$P_c = 63,940 + 5880 = 69,820^*$$

$$f_c = \frac{69,820}{3.45} = 20,500 \text{#/in}^2 \quad *(\text{REF. FZS-36-242 P.II-31})$$

ALLOWABLE COMPRESSIVE STRESS:

$$F_c = 36,500 \text{#/in}^2 \quad (\text{REF. FZS-36-142 P.II-35})$$

$$M.S. = \frac{36,500}{20,500} - 1 = +.78$$

TENSILE STRESS IN THE UPPER FLANGE (COND: DGW-2WL-IR-ND)

$$P_t = \frac{M}{h} = \frac{s t u \cot \alpha}{2}$$

$$= 56,800 - 1,140 = 49,660^*$$

$$P'_t = 9890 \times \frac{27.087}{66.738} = 4010^*$$

$$P_{t(\text{TOTAL})} = 49,660 - 4010 = 45,650^*$$

$$f_t = \frac{45,650}{2.718} = 16,800 \text{#/in}^2 \quad *(\text{REF. FZS-36-142 P.II-31})$$

$$F_t = 45,600 \text{#/in}^2 \quad (\text{REF. FZS-36-142 P.II-35})$$

$$M.S. = \frac{45,600}{16,800} - 1 = +1.72$$

ANALYSIS WING III  
PREPARED BY J. GIL  
CHECKED BY T. J. MURRAY  
REVISED BY

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FORT WORTH DIVISION  
FORT WORTH, TEXAS

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WING BULKHEAD #11

THE MINIMUM FLYING WEIGHT - I.L.A.A @ 5000 CONDITION  
GIVES THE MAXIMUM COMPRESSIVE STRESS IN THE  
UPPER FLANGE:

$$M = 2,875,500^{\dagger} \#$$

$$S_a = 7016 \#$$

$$S_{CR} = 3140 \#$$

$$S_{UV} = \frac{7016}{1191} - 3140 = 2760 \#$$

$$P_c = \frac{2875,500}{66.74} + \frac{2760}{2} (1.086)$$

$$P_c = 44,590 \#$$

AXIAL LOAD:

$$P'_c = 5760 \times \frac{27.087}{66.738} = 2340 \#$$

TOTAL FLANGE LOAD:

$$P_{CGO...} = 44,590 + 2340 = 46,930 \#$$

$$f_c = \frac{46,930}{2.718} = 17,300 \text{ "#/in"}$$

$$M.S. = \frac{36,500}{17,300} - 1 = +1.11$$

STIFFENER ANALYSIS:

THE STIFFENERS ARE DESIGNED PRIMARILY BY  
FUEL PRESSURE FROM THE SIDE DRIFT LANDING  
CONDITION AND SINCE THE SIDE INERTIA  
FACTOR HAS BEEN REDUCED FROM 1.437  
AG.W (112-500# BOMBS), SIDE DRIFT LANDING,  
FOR THE XB-36A (REF. FES-36-141, P.284) TO  
1.408, AGW (112-500# BOMBS), SIDE DRIFT  
LANDING FOR THE XB-36 (REF. FES-36-243, P143).  
THE VALUES OF THE TABLE II-II R II-39  
(REF. FES-36-142) WILL BE  $\frac{1.437}{1.408}$  OR 2%  
CONSERVATIVE FOR THE XB-36.

ANALYSIS WING III  
PREPARED BY J.C.L.  
CHECKED BY Lawley  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation

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DATE 4-19-48

WING PULP HEAD #11

CONDITION: III AGW (112.500<sup>2</sup> B-MBS); SIDE DRIFT  
LANDING

STIFFNER ANALYSIS

TABLE XXXVII

STIFFNER REF. 36WIII	B-36A REF FPM 3-14- P II-39		XB-36		$F_t = 56,000$ M.S. (TEN.)	$F_c = 61,000$ M.S. (COMP)
	TENSILE STRESS	C-IMPERFECT STRESS	TENSILE STRESS	COMPRESSIVE STRESS		
① REF. 36WIII	(3)	.3	4 $1.408 \times 2$	5 $1.408 \times 3$	6 $\frac{F_t}{4} - 1$	7 $\frac{F_c}{5} - 1$
-13	42,100	41,500	41,400	40,700	+.35	+.50
-14	51,300	50,700	50,400	49,700	+.11	+.23
-15	53,500	52,900	52,500	51,900	+.06	+.17
-16	48,300	47,600	47,400	46,700	+.18	+.30
-17	51,400	50,800	50,500	49,900	+.11	+.22
-18	49,900	49,200	49,000	48,300	+.14	+.26
-19	47,200	46,600	46,300	45,800	+.21	+.33
-20	43,800	44,100	43,500	43,300	+.30	+.41
-21	41,600	41,800	40,800	41,100	+.37	+.48
-22	42,800	43,900	42,000	43,100	+.33	+.41
-23	38,600	39,400	37,900	38,700	+.47	+.57

ANALYSIS WING  
PREPARED BY LOWREY  
CHECKED BY M. Ford  
REVISED BY

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FORT WORTH, TEXAS

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WING BULKHEAD 18

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M.F.W. (136,018 <sup>3</sup> ) ILAA @ 5000 FT.	<u>179</u>
JACKING COND - D6 W. (205,192 <sup>3</sup> )	<u>188</u>
SIDE DRIFT LANDING COND	<u>188</u>
DETAIL ANALYSIS	<u>189</u>

ANALYSIS WING  
PREPARED BY Conrey  
CHECKED BY Johmson  
REVISED BY

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FORT WORTH DIVISION  
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## WING BULKHEAD #18

### DISCUSSION:

BULKHEAD #18 IS LOCATED 576.5 INCHES FROM THE AIRPLANE CENTER LINE. IT IS OF THE TENSION FIELD TYPE, CONSTRUCTED ENTIRELY OF ALUMINUM ALLOYS. THE FOUR CONDITIONS THAT HAVE BEEN DETERMINED AS BEING CRITICAL, ARE:

- (1) MIN. FLYING WT. (136,018<sup>#</sup>), L.A.A., UNSYM. GUST, H.S. @ 5000 FT. - REF. P. 170
- (2) MIN. FLYING WT. (136,018<sup>#</sup>) ILAA, UNSYM. GUST, HS @ 5000 FT. - REF. P. 179
- (3) JACKING COND. - D.G.W. (265,192<sup>#</sup>)
- (4) SIDE DRIFT LANDING, ALT. G.W. (112-500<sup>#</sup> BOMBS)

THESE CONDITIONS ARE THE SAME AS THOSE FOUND TO BE CRITICAL FOR THE B-36A AIRPLANE (REF. F25-36-142, PG II-98). DUE TO THE FACT THAT DIFFERENT CRITERIA WAS USED FOR DETERMINING GUST FACTORS ON THE XB-36 AIRPLANE, THE LOADINGS FOR CONDITIONS (1) AND (2), SHOWN ABOVE WILL BE HIGHER FOR THE XB-36 AIRPLANE.

ENGINE MOUNT FITTING LOADS INTRODUCED INTO THE WING BOX AT BULKHEAD #18 ARE OBTAINED FROM REPORT F25-36-253 AND ARE TABULATED ON PG 169.

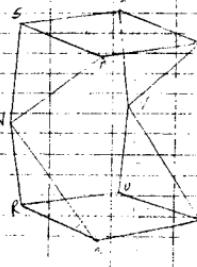
THE XB-36 BULKHEAD LOADS DUE TO AIRLOADS, CRUSHING LOADS, AND GAS LOADS FOR CONDS. (1) AND (2) ARE OBTAINED FROM THE B-36A LOADS AS SHOWN ON THE FOLLOWING PAGES. THE MEMBERS THAT ARE CRITICAL FOR CONDS. (3) + (4) WILL NOT BE ANALYZED HERE BECAUSE THE XB-36 LOADS ARE SMALLER THAN THE B-36A LOADS AND IT WILL BE CONSIDERED CONSERVATIVE TO USE MARGINS SHOWN FOR B-36A (REF. F25-36-242, PGs. I-141 TO II-147).

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FORT WORTH DIVISION FORT WORTH, TEXAS

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DATE: 11-47

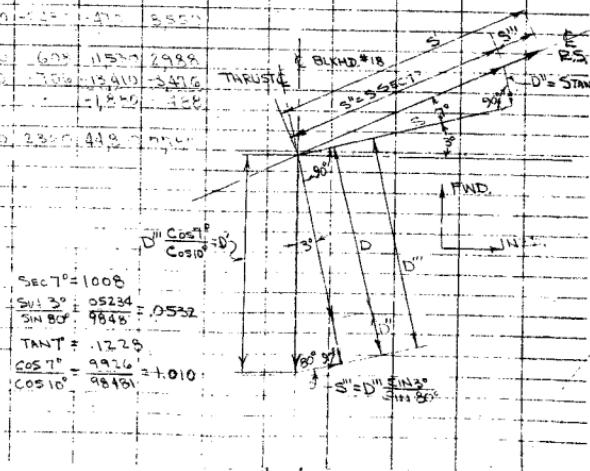
FOR	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
LOAD	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FES	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
FES	13	14	15	16	17	18	19	20	21	22	23	24	25	26
S	A.S.	70.45	265	-29	24	25	26	27	28	29	30	31	32	33
W	AW	12.12	-5.9	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.11
C.W.	28.21	-1.12	1.13	1.14	1.15	1.16	1.17	1.18	1.19	1.20	1.21	1.22	1.23	1.24
NET W														
R	C.R.													
S	A.S.													
W	AW													
C.W.														
NET W														
R	C.R.													



S + R ATTACH R TO CF BLK 5 "14  
T, Vtu ATTACH TO 25.44 BLK 5 "16

TOP OF LBL  
15 1/8" 2

FRONT 15 1/8"  
10" 6"



ANALYSIS WING  
PREPARED BY LONREY  
CHECKED BY Johansen  
REVISED BY \_\_\_\_\_

**Consolidated Vultee Aircraft Corporation**  
**FORT WORTH DIVISION**  
**FORT WORTH, TEXAS**

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REPORT NO. F25-36-242  
MODEL X8-36  
DATE 5/13/98

WING BULKHEAD 18

## AIRLOADS

CONDITION: MIN FLYING WT., L.A.A., H.S. @ 5000 FT.

THE B-36A AND XB-36 AIRLOAD PRESSURE DISTRIBUTION WILL BE ASSUMED THE SAME. THE B-36A AIRLOADS, (REF. F25-36-142, PG. I - III) WILL BE RATIOED IN PROPORTION TO THE TOTAL WING AIRLOADS OF THE TWO AIRPLANES TO OBTAIN THE AIRLOADS FOR THE XB-36 BULKHEAD.

B-36A :

$$\left. \begin{array}{l} \Sigma = +3.597 \\ W \\ W = 136, 713^* \end{array} \right\} \quad \begin{array}{l} FZS-36-136 \\ PG. 71 \end{array}$$

$$Z = 492,000^*$$

XB-36 :

$$\left. \begin{array}{l} \frac{Z}{W} = +4.256 \\ W = 136,018^* \end{array} \right\} \begin{array}{l} FZ5-36-126 \\ PG. 84 \end{array}$$

$$Z = 579\,000^*$$

$$\text{RATIO} = \frac{579,000}{493,000} = 1.178$$

XB-36 AIRLOADS = G-36A AIRLOADS X 1.178

ANALYSIS WING  
PREPARED BY LOWREY  
CHECKED BY Johansen  
REVISED BY \_\_\_\_\_

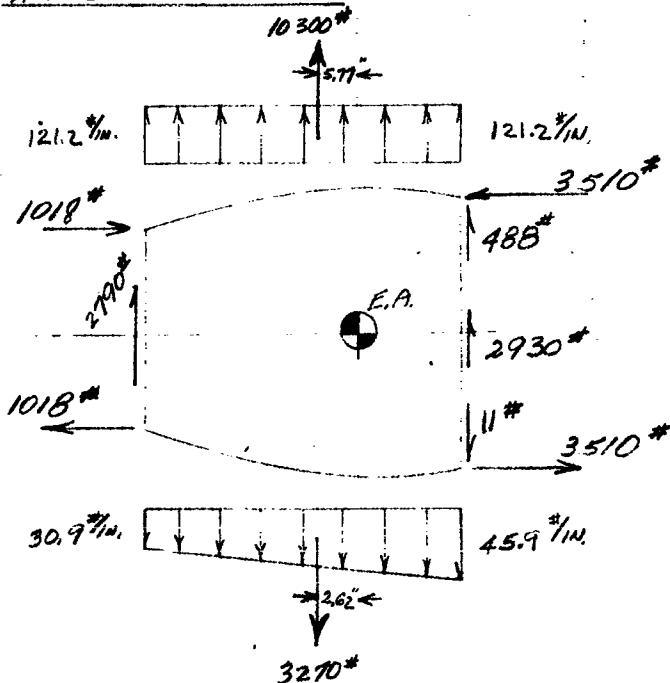
Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. F2S-36-242  
MODEL XB-36  
DATE 5/13/48

WING BULKHEAD #18

AIRLOADS (CONT'D.)

XB-36 AIRLOADS



FOR B-36A AIRLOADS SEE F2S-36-142, PG II-111

CRUSHING LOADS

COND.: MIN. FLYING WT., L.A.A., H.S. AT 5000 FT.

THE B-36A CRUSHING LOADS, (REF. F2S-36-142, PG. II-111), WILL BE RATIOED IN PROPORTION TO THE SQUARE OF THE BENDING MOMENTS TO OBTAIN THE XB-36 CRUSHING LOADS.

ANALYSIS WING  
PREPARED BY LOWREY  
CHECKED BY Johansen  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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MODEL XB-36  
DATE 5/13/48

WING BULKHEAD #18:

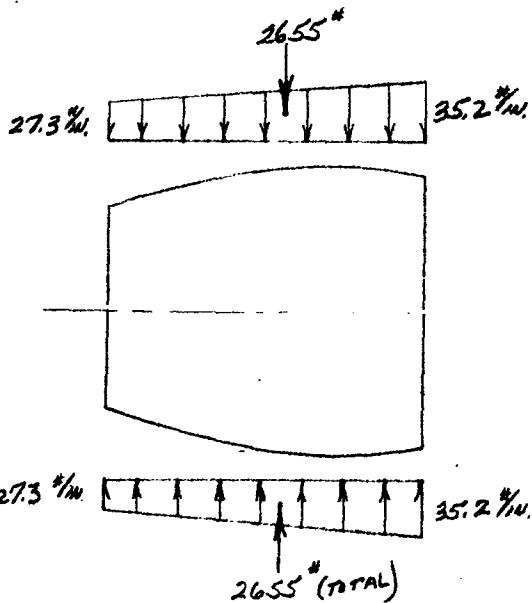
CRUSHING LOADS (CONT'D)

B-36A: B.M. = 32,266,000<sup>"\*</sup> (REF F25-36-142, PG II-110)

XB-36 : B.M. = 37,550,000<sup>"\*</sup> (PRELIMINARY CALCULATIONS)

$$\text{RATIO} = \frac{(37\ 550\ 000)^2}{(32\ 266\ 000)^2} = 1.352$$

XB-36 CRUSHING LOADS = B-36A CRUSHING LOADS X 1.352



FOR B-36A CRUSHING LOADS SEE F25-36-142, PG. II-111

FUEL LOADS

COND: MIN. FLYING WT., L.A.A., UNSYM. GUST @ 5,000'

THE FUEL LOADS WILL BE RATIOED  
FROM THE B-36A FUEL LOADS, IN  
PROPORTION TO THE VERTICAL LOAD FACTORS.  
SEE REF. F25-36-142, PG. II-111 FOR B-36A  
FUEL LOADS.

ANALYSIS WING  
PREPARED BY LAWREY  
CHECKED BY Johansen  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. FZS-36-242  
MODEL XB-36  
DATE 5/13/98

WING BULKHEAD # 18

FUEL LOADS (CONT'D.)

B-36A:

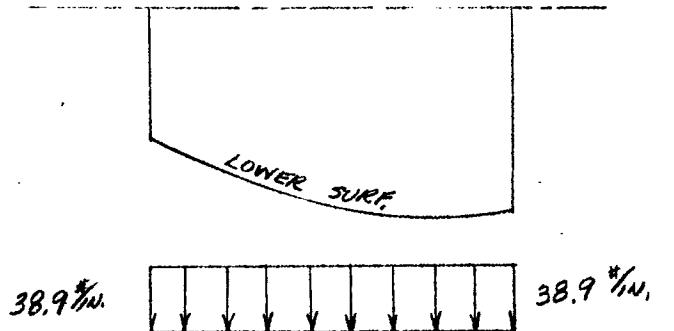
$$n_y = -5.64 \quad (\text{REF. FZS-36-153, PG. 10})$$

XB-36:

$$n_y = -6.572 \quad (\text{REF. FZS-36-253, PG. 8})$$

$$\text{RATIO} = \frac{6.572}{5.64} = 1.168$$

XB-36 FUEL LOADS = B-36A FUEL LOADS  $\times 1.168$



FOR B-36A FUEL LOADS SEE FZS-36-192, PG II-111

ANALYSIS WING  
PREPARED BY Conway  
CHECKED BY Johansen  
REVISED BY \_\_\_\_\_

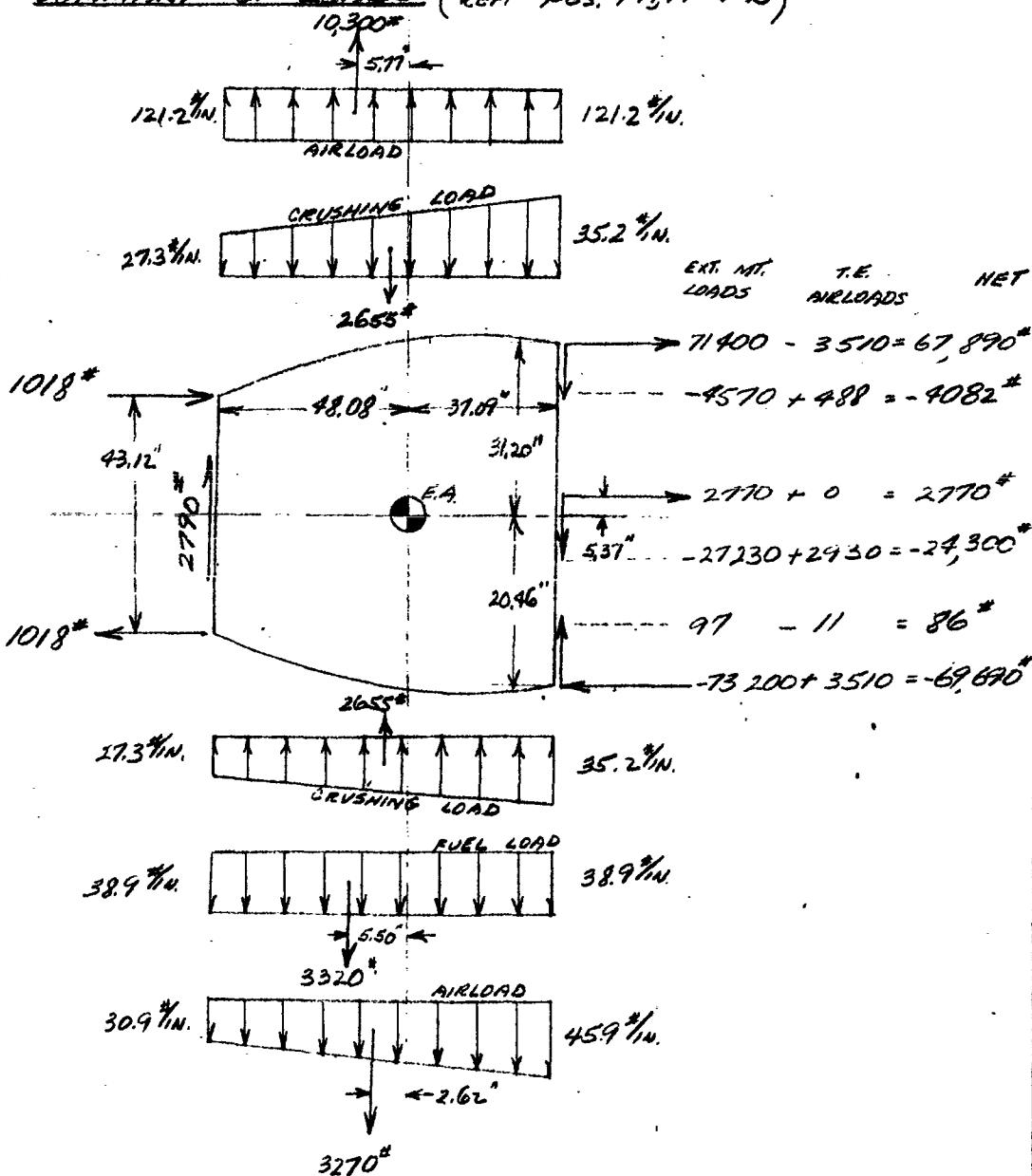
Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. F25-36-242  
MODEL XB-36  
DATE 5/13/48

WING BULKHEAD #18

CONDITION - M.F.W., L.A.A., U. GUST @ 5000 FT.

SUMMARY OF LOADS (REF PGS. 171, 172 & 173)



ANALYSIS WING  
PREPARED BY LAWREY  
CHECKED BY Johansen  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. FZS-36-242  
MODEL XB-36  
DATE 5/13/48

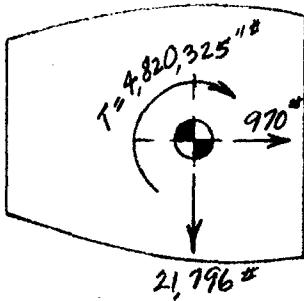
WING BULKHEAD #18

E LOADS ABOUT E.A.

$$\begin{aligned}\Sigma V &= 10,300 - 4,082 - 24,300 + 86 - 3,270 - 3,320 + 2,790 \\ &= \underline{-21,796}^{\#}\end{aligned}$$

$$\Sigma D = 67,890 + 2,770 - 69,690 = \underline{970}^{\#}$$

$$\begin{aligned}T_{E.A.} &= (10,18 \times 43.12) + (2,790 \times 48.08) + (10,300 \times 5.77) \\ &\quad - (3,320 \times 5.50) - (3,270 \times 2.62) + (2,829.6 \times 37.09) \\ &\quad + (6,799.0 \times 31.2) + (2,770 \times 5.37) + (69,690 \times 20.46) \\ &= \underline{4,820,325}^{\#}\end{aligned}$$



APPLIED LOADS ARE REACTED BY SHEAR FLOWS:

$$S_T = \frac{T}{2A} = \frac{4,820,325}{2 \times 4,665} = 517 \frac{1}{4} \text{ in.}$$

ANALYSIS WING  
PREPARED BY LOWREY  
CHECKED BY JOHNSON  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. FZS-36-242  
MODEL XG-36  
DATE 5/13/58

WING BULKHEAD #18

E LOADS ABOUT E.A. (CONT'D.)

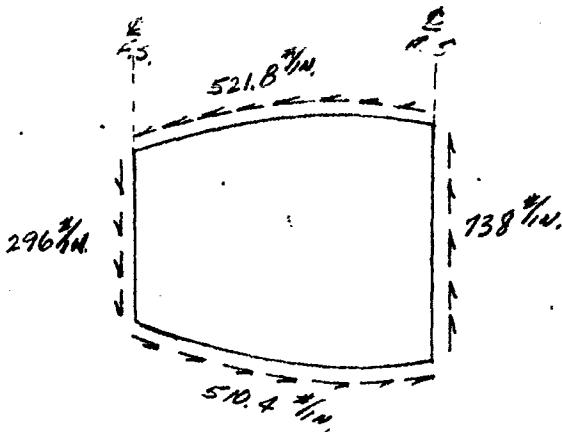
$$q_{FS} = 21,796 \left( \frac{37.09}{85.17} \right) \frac{1}{43.12} = 221 \frac{1}{4} \text{ in.}$$

$$q_{RS} = 21,796 \left( \frac{48.08}{85.17} \right) \frac{1}{55.72} = 221 \frac{1}{4} \text{ in.}$$

$$q_U = 970 \left( \frac{25.79}{60.84} \right) \frac{1}{85.17} = 4.8 \frac{1}{4} \text{ in.}$$

$$q_L = 970 \left( \frac{35.05}{60.84} \right) \frac{1}{85.17} = 6.6 \frac{1}{4} \text{ in.}$$

NET BALANCING SHEAR FLOWS



SUMMATION OF "V", "P" + "M" FOR SECTIONS

$$V_{FS} = -12780 + 2790 = -9990^*$$

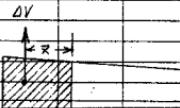
$$M_{FS} = M_L' = 43,900^*$$

$$P = 0$$

WING BULKHEADS - 18  
ULT. SHEARS, BENDING MOMENT AND AXIAL LOADS  
MF.W. (136,018) L.A.A. UNSYM. GUST @ 520°

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F25-36-242  
X8-36

STATION INCHES FROM R.S.	$A_u$	$A_L$	$D_{h_u}$	$D_h$	$D_{V_L}$	$X_a$	$D_V^*$	$\bar{X}_f$	$D_{V_L} =$ $\frac{A_L}{A_u + D_h}$	$D_{V_L} =$ $\frac{V_{fa}}{V_{fa} + D_h}$	$M_{fa} =$ $\frac{M_{fa}}{M_{fa} + D_h}$	$A_{V_L} =$ $\frac{A_h}{A_u + D_h}$	$D_{V_L} =$ $\frac{A_h}{A_h + D_h}$	$D_{M_{fa}} =$ $\frac{M_{fa}}{M_{fa} + D_h}$	$D_{M_{fa}} =$ $\frac{M_{fa}}{M_{fa} + D_h}$	$V_{fa} =$ $\frac{V_{fa}}{V_{fa} + D_h}$	AXIAL LOAD IN. LBS. LONG. AND TRANS. LAMMAS		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	
	(REF F25-36-142, PG II-115)																		
F.S.	0	0	0	0	0	0	0	0	0	0	-7710	0	0	0	0	0	43980	0	
	17.03	250.1	191.8	4.9	3.1	1512	8.57	-662	8.51	-2530	-1582	-12,212	-26,000	-16,800	12,480	-56,30	-179,100	-575,60	-194
	34.07	565.1	424.7	7.9	4.9	2160	17.23	-132.8	17.03	-4120	-2500	-14,978	-51,020	-43,000	50,100	-22,600	-310,000	-137,300	-318
	51.10	922.1	677.5	9.8	5.4	4380	26.00	-1990	2555	-5110	-2755	-15465	-769,000	-672,000	11,200	-50,300	-510,800	-205,700	-372
	68.14	1296.4	929.5	10.0	9.9	5750	34.70	-2655	3457	-5218	-2500	-14,613	1352,000	-94,800	200,500	-70,320	-310,00	-2,826,100	-776
R.S.	85.17	1664.6	1163.8	9.2	3.4	7030	43.70	-3320	42.87	-4790	-1735	-12,805	-1,7820,00	-1,18,000	20,070	-19,200	-851,800	-3,567,100	-110



$\bar{X}_f = 5218 \text{ in.}$

$\Delta h_u$

$M_{fa} = 133,000$

$V_{fa} = -9710$

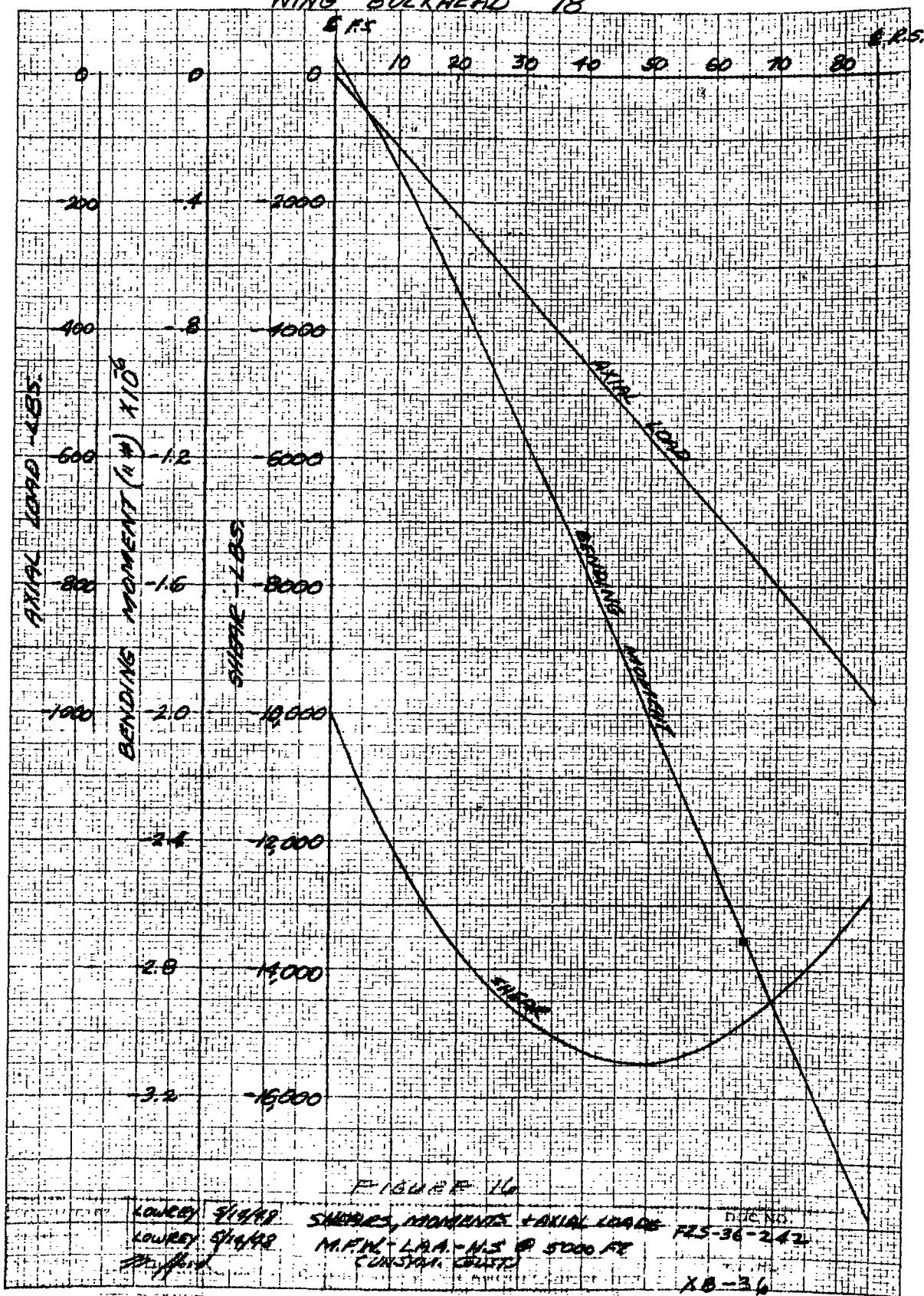
$\Delta h_h$

$\Delta h_h$

\* SUBSCRIPT "a" DENOTES AIR LOADS.  
+ DENOTES FULL LOADS.

PREPARED BY: LOWREY 5/18/48  
CHECKED BY: Langley 5/25/48

## WING BULKHEAD #18



ANALYSIS WING  
PREPARED BY LON REY  
CHECKED BY T. H. MCGEEY  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation

FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. F25-36-142  
MODEL XB-36  
DATE 5/13/48

WING BULKHEAD #18

AIRLOADS

CONDITION: MIN. FLYING WT, I.L.A.A., H.S. @ 5000 FT.

THE B-36A AND XB-36 AIRLOAD PRESSURE DISTRIBUTION WILL BE ASSUMED THE SAME. THE B-36A AIRLOADS (REF. F25-36-142, PG II-124) WILL BE RATIOED IN PROPORTION TO THE TOTAL WING AIRLOADS OF THE TWO AIRPLANES TO OBTAIN THE AIRLOADS FOR THE XB-36 BULKHEAD.

B-36A:

$$\frac{Z}{W} = -1.494 \quad \left. \begin{array}{l} \\ W = 136,712^* \end{array} \right\} \text{F25-36-136, PG 72}$$

$$Z = 204,500^*$$

XB-36:

$$\frac{Z}{W} = -2.043 \quad \left. \begin{array}{l} \\ W = 136,018^* \end{array} \right\} \text{F25-36-126, PG 84}$$

$$Z = 278,000^*$$

$$\text{RATIO} = \frac{278,000}{204,500} = 1.36$$

$$\text{XB-36 AIRLOADS} = \text{B-36A AIRLOADS} \times 1.36$$

ANALYSIS WING  
PREPARED BY LOWREY  
CHECKED BY Chaykin  
REVISED BY \_\_\_\_\_

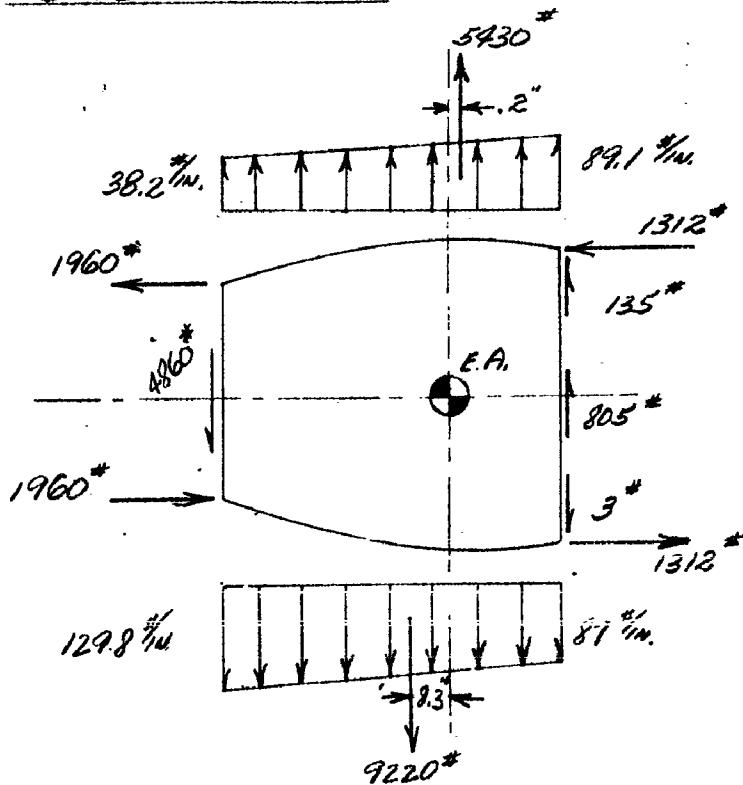
Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. F25-36-242  
MODEL XB-36  
DATE 5/13/48

WING BULKHEAD #15

AIRLOADS (CONT'D.)

XB-36 AIRLOADS



FOR B-36A AIRLOADS SEE F25-36-142, PG II-124

CRUSHING LOADS

COND.: MIN. FLYING WT., I.L.A.A., H.S @ 5000FT.

THE B-36A CRUSHING LOADS (REF. F25-36-142, PG II-124), WILL BE RATIOED IN PROPORTION TO THE SQUARE OF THE BENDING MOMENTS TO OBTAIN THE XB-36 CRUSHING LOADS.

ANALYSIS WING  
PREPARED BY LOWREY  
CHECKED BY T. R. G.  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. F25-36-242  
MODEL XB-36  
DATE 5/13/48

## WING BULKHEAD #18

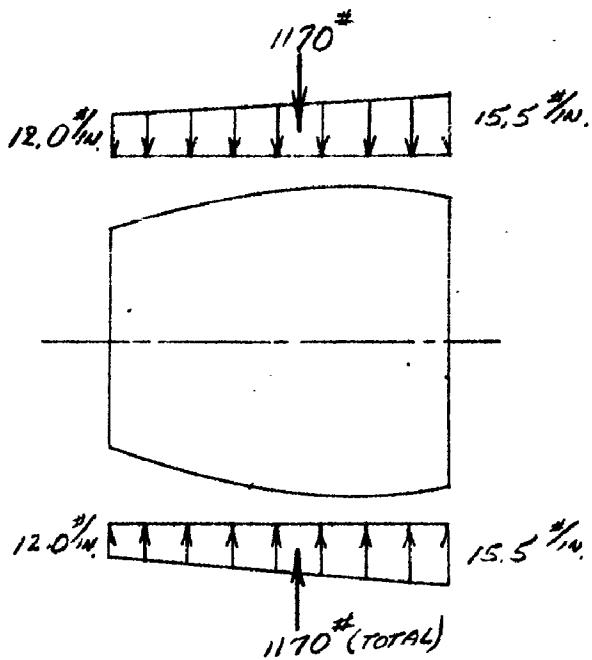
### CRUSHING LOADS (CONT'D)

B-36A: B.M. = 18,911,000"\*\* (F25-36-142, PG. II-123)

XB-36: B.M. = 37,550,000"\*\* (PRELIMINARY CALCULATIONS)

$$\text{RATIO} = \frac{(27,990,000)^2}{(18,911,000)^2} = 1.74$$

XB-36 CRUSHING LOADS = B-36A CRUSHING LOADS X 1.74



FOR B-36A CRUSHING LOADS SEE F25-36-142, PG. II-124

### FUEL LOADS

COND: MIN. FLYING WT., I.L.A.A., UNSYM. GUST @ 5,000'

THE FUEL LOADS WILL BE RATIOED FROM THE B-36A FUEL LOADS, IN PROPORTION TO THE VERTICAL LOAD FACTORS. SEE F25-36-142, PG. II-124, FOR B-36A FUEL LOADS.

ANALYSIS WING  
PREPARED BY COWKEY  
CHECKED BY Wright  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. F25-36-242  
MODEL XB-36  
DATE 5/14/48

WING BULKHEAD #18

FUEL LOADS (CONT'D)

B-36A:

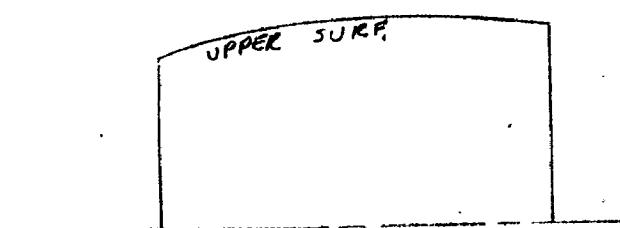
$$N_V = 2.60 \text{ (REF F25-36-153, PG 11)}$$

XB-36:

$$N_V = 3.40 \text{ (REF F25-36-253, PG 11)}$$

$$\text{RATIO} = \frac{3.40}{2.60} = 1.31$$

XB-36 FUEL LOADS = B-36A FUEL LOADS  $\times 1.31$



FOR B-36A FUEL LOADS SEE F25-36-142, PG 124.

ANALYSIS WING  
PREPARED BY LAWRENCE  
CHECKED BY C. L. COOPER  
REVISED BY \_\_\_\_\_

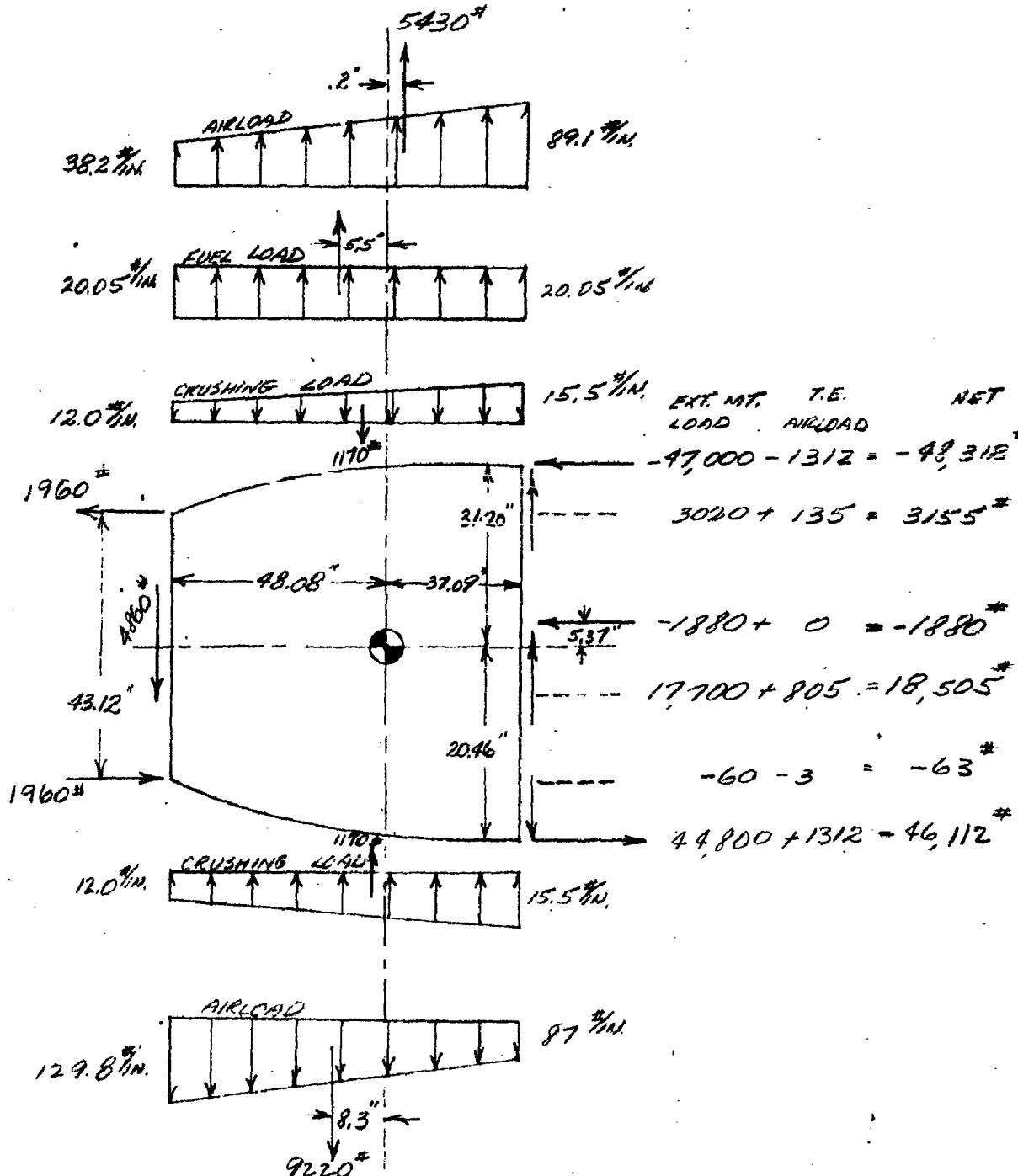
Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. F25-36-242  
MODEL XB-36  
DATE 5/19/68

WING BULKHEAD #18

CONDITION - M.F.W., I.L.A.A., UNSYM. GUST @ 5000'

SUMMARY OF LOADS (REF. PG. 180, 181 & 182)



ANALYSIS WING  
PREPARED BY LOWREY  
CHECKED BY T. Mayfield  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

PAGE 184  
REPORT NO. FZ5-36-242  
MODEL XB-36  
DATE 5/18/48

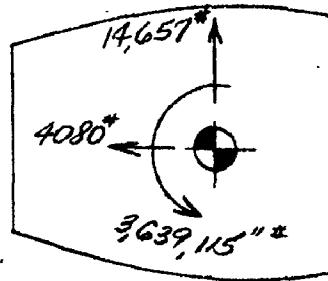
WING BULKHEAD #18

Z LOADS ABOUT E.A.

$$\begin{aligned} \Sigma V &= -4860 + 5430 + 3155 + 18,505 - 63 \\ &\quad + 1710 - 9220 \\ &= \underline{14,659^*} \end{aligned}$$

$$\Sigma D = -48312 - 1880 + 46,112 = \underline{-4080^*}$$

$$\begin{aligned} T_{E.A.} &= -(1960 \times 43.12) - (4860 \times 48.08) - (5430 \times .2) \\ &\quad - (21,377 \times 37.09) + (1710 \times 5.5) - (9220 \times 8.3) \\ &\quad - (48,912 \times 31.2) - (1880 \times 5.37) - (46,112 \times 20.46) \\ &= \underline{3,639,115^{**}} \end{aligned}$$



APPLIED LOADS ARE REACTED BY SHEAR FLOWS:

$$q_T = \frac{T}{2A} = \frac{3,639,115}{2 \times 46605} = 390 \text{ lb/in.}$$

ANALYSIS WING  
PREPARED BY LOWREY  
CHECKED BY D. J. G.  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. EC-36-246  
MODEL XB-36  
DATE 5/14/42

WING BULKHEAD #18

$\Sigma$  LOADS ABOUT E.A (CONT'D.)

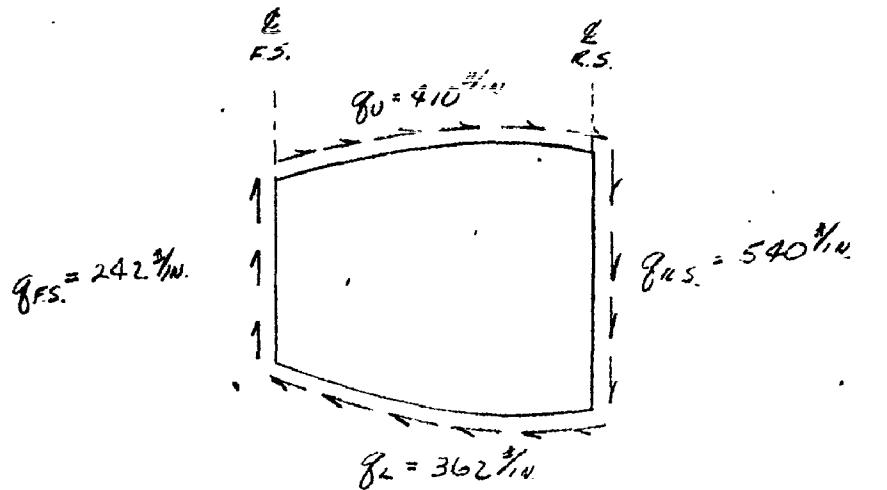
$$q'_{FS} = 14,657 \left( \frac{37.09}{85.17} \right) \frac{1}{43.12} = 148 \frac{\text{lb}}{\text{in}}$$

$$q'_{RS} = 14,657 \left( \frac{48.08}{85.17} \right) \frac{1}{55.72} = 150 \frac{\text{lb}}{\text{in}}$$

$$q'_U = 4080 \left( \frac{25.79}{60.84} \right) \frac{1}{85.17} = 20 \frac{\text{lb}}{\text{in}}$$

$$q'_L = 4080 \left( \frac{35.05}{60.84} \right) \frac{1}{85.17} = 28 \frac{\text{lb}}{\text{in}}$$

NET BALANCING SHEAR FLOWS.



SUMMATION OF "V", "P", AND "M" FOR SECTIONS

$$V_{FS} = 10,520 - 4860 = 5660^*$$

$$M_{FS} = M'_e = -84,500^*$$

$$P = 0$$

CONSOLIDATED VULTEE AIRCRAFT CORPORATION  
FORT WORTH DIVISION  
FW 633 7-48 ENGINEERING RULED TABULATION PAD—VELVUM

WING BULKHEAD #18

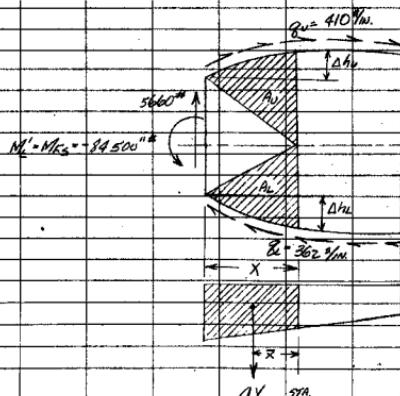
TABLE ULT. SHEARS, BENDING MOMENTS, AND AXIAL LOADS  
MIN FLYING ALT - Z-E.O.A., UNSVAR GUST @ 5000'

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F25-36-242

18-36

STATION INCHES FROM FRONT F.S.	A <sub>1</sub>	A <sub>2</sub>	A <sub>h1</sub>	A <sub>h2</sub>	DV <sub>1</sub>	X <sub>o</sub>	A <sub>F</sub>	X <sub>F</sub>	A <sub>V1</sub> = 40x10 40x10	A <sub>V2</sub> = 16.176 16.176	K <sub>M</sub> = 1.671042 1.671042	M <sub>1</sub> = 2.013 2.013	D <sub>1</sub> = 1.912 1.912	D <sub>2</sub> = 0.744 0.744	A <sub>V3</sub> = 1.912 1.912	M <sub>2</sub> = 1.671042 1.671042	M <sub>3</sub> = 1.671042 1.671042	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	
(REF. F25-36-142, PG II-115)																		

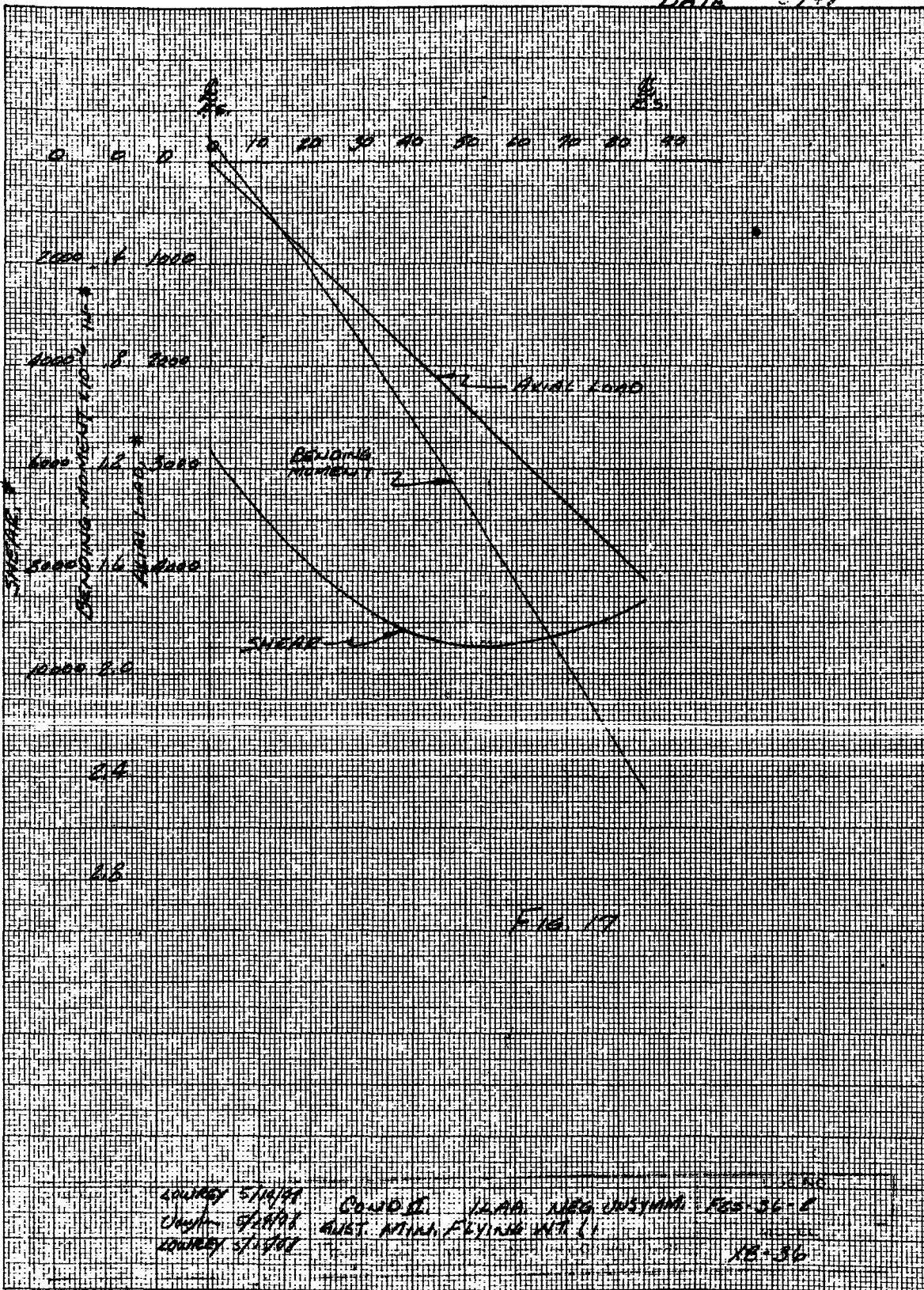
F.S.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-84,500	0	
17.03	250.1	191.8	4.1	3.1	-1365	3.84	341	8.51	2010	1132	7767	205,000	138,600	-12,050	2900	96,600	-346,550	820	
34.07	565.8	424.7	7.9	4.9	-2930	18.75	690	17.03	3240	1715	8935	469,000	307,500	-44,800	11730	192,800	-846,730	1635	
51.10	922.1	677.5	9.8	5.4	-3185	2920	1035	25.55	4020	1955	9735	756,000	491,000	-93,000	26,450	287,000	-1,384,750	2450	
68.14	1276.4	927.5	10.0	4.9	-3650	41.60	1384	34.07	4100	1775	9269	1,063,000	673,000	-151,800	47,200	386,000	-1,933,900	3270	
R.S.	85.17	1667.6	1163.8	9.2	3.4	-3790	56.80	1710	42.58	3770	1230	8600	1365,000	882,600	-215,000	72,800	492,000	-2,462,700	4070



\* SUBSCRIPT "2" DENOTES AIRLOADS  
\* "3" DENOTES FUEL LOADS

PREPARED BY: LOWKEY 5/12/48  
CHECKED BY: Zayton 5/11/48

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REPORT NO. F25-3-  
MODEL X1  
DATE 5/46



ANALYSIS WING  
PREPARED BY LONKEY  
CHECKED BY M. J. F.  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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MODEL XB-36  
DATE \_\_\_\_\_

WING BULKHEAD #18

JACKING CONDITION - D.G.W. (265,000")

NO ANALYSIS WILL BE SHOWN FOR MEMBERS CRITICAL FOR THIS CONDITION, BECAUSE THE DESIGN GROSS WT HAS BEEN REDUCED FROM 278,000<sup>#</sup> ON THE B-36A TO 265,000<sup>#</sup> ON THE XB-36. THE B-36A ANALYSIS WILL BE USED AND CONSIDERED CONSERVATIVE. (REF. F25-36-142, PG. II-129). THIS CONDITION IS CRITICAL FOR THE WEB AND HOR. STIFFENER'S.

SIDE DRIFT LANDING COND. [A.G.W. (112-500<sup>#</sup> BOMBS)]

THE SIDE DRIFT LANDING CONDITION IS CRITICAL FOR THE BULKHEAD VERTICAL STIFFENERS, AS A RESULT OF FUEL PRESSURES PRODUCED BY THE SIDE INERTIA FORCE IN THE A.G.W. - S.D.L. CONVENTION.

$$P = \frac{6}{231} \times n_s \times h$$

WHERE:

$n_s = 1.408$  = ULT. AIRPLANE SIDE LOAD FACTOR  
(REF. F25-36-243, PG. 183)

$h$  = SPANNWISE LENGTH OF FUEL CELL.  
(STA. #18 TO STA. #22 = 155.5")

$$P = \frac{6}{231} \times 1.408 \times 155.5 = \underline{\underline{5.68 \text{ lb/in}^2}}$$

$$P(B-36A) = 5.81 \text{ lb/in}^2 \text{ (REF. F25-36-142, PG. II-138)}$$

THE SIDE DRIFT LANDING COND. LOADING IS SLIGHTLY SMALLER THAN THE B-36A LOADS, SO THE B-36A ANALYSIS WILL BE CONSERVATIVELY USED, FOR THE XB-36, FOR MEMBER'S CRITICAL FOR THIS CONDITION.

ANALYSIS WING  
PREPARED BY LOUREY  
CHECKED BY Meffert  
REVISED BY \_\_\_\_\_

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FORT WORTH, TEXAS

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DATE 5/19/68

WING BULKHEAD #18

DETAIL ANALYSIS

THE DETAIL ANALYSIS OF THIS BULKHEAD MAY BE DIVIDED INTO THE FOLLOWING PARTS.

- (1) BULKHEAD WEB AND ATTACHMENTS.
- (2) BULKHEAD WEB STIFFENERS.
- (3) BULKHEAD CHORD MEMBERS

PART

CRITICAL CONDITION

- (1) D.G.W. - JACKING CONDITION.  
(FOR DISCUSSION SEE PG 168)
- (2) A.G.W. - SIDE DRIFT LANDING.  
(FOR DISCUSSION SEE PG 168)
- (3) M.F.W (136,018<sup>#</sup>) I.L.A.A. AND L.A.A.  
UNSYM. GUST, H.S. @ 5000 FT.  
(SEE FOLLOWING PAGES)

ANALYSIS WING  
PREPARED BY LOWREY  
CHECKED BY Thompson  
REVISED BY \_\_\_\_\_

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FORT WORTH, TEXAS

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DATE 5/14/48

WING BULKHEAD #18

CHORD MEMBER ANALYSIS

UPPER CHORD

THIS MEMBER WILL BE CHECKED AT THE POINT OF MAX. MOMENT FOR THE MIN. SECTION, WHICH IS 57.2" AFT OF THE FRONT SPAR. ILAA CONDITION PRODUCES THE CRITICAL COMPRESSIVE STRESS IN THIS MEMBER. THIS CHORD MEMBER IS THE SAME AS THE XB-36A CHORD MEMBER.

$$h_0 = 33.7"$$

$$h_1 = 24.2"$$

$$h = h_0 + h_1 = 57.9"$$

$$A_{ch} = 1.247 \text{ sq.in.}$$

REF. F25-36-142  
PG. II-139

# 36W118

$$V = 9480^*$$

$$M_i = 1,580,000^* \quad \text{PG. 181}$$

$$P = 2750^*$$

$$\text{FLANGE LOAD}, P_f = \frac{M_i}{h} + P \left( \frac{h_1}{h} \right) + \frac{V \cot \alpha}{2}$$

$\cot \alpha = 1.15$  (REF. F25-36-142, PG. II-141)  
ASSUMED SAME  $\cot \alpha$

$$P_f = \frac{1580,000}{57.9} + 2750 \left( \frac{24.2}{57.9} \right) + \frac{9480 \times 1.15}{2}$$

$$= 33,910^*$$

ANALYSIS WING  
PREPARED BY LOWREY  
CHECKED BY Jayhanna  
REVISED BY \_\_\_\_\_

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WING BULKHEAD #18

UPPER CHORD (CONT'D)

$$f_{cu} = \frac{33,910}{1.247} = 27,200 \text{ lb/sq.in.}$$

$$F_c = 30,000 \text{ lb/sq.in. (REF. F25-36-142, PG. II-149)}$$

$$M.S. = \frac{30,000}{27,200} - 1 = +.10$$

THE CRITICAL TENSION STRESSES IN THIS MEMBER ARE PRODUCED BY L.A.A. COND., AT THE POINT OF MAX. MOMENT FOR THE MIN. SECTION AT 57.2" AFT OF THE FRONT SPAR. THE EFFECTIVE AREA IS ASSUMED AS EQUAL TO THAT USED IN THE COMPRESSION ANALYSIS, WHERE THE ENTIRE EXTRUDED "T" WAS NOT USED.

$$\left. \begin{aligned} V &= -15,300^* \\ M &= -2,370,000^* \\ P &= -655^* \end{aligned} \right\} \text{REF. PG. 178}$$

$$P_e = \frac{M}{h} + P \left( \frac{h_0}{h} \right) = \frac{-2,370,000}{57.9} + (-655) \left( \frac{24.2}{57.9} \right) \\ = -41,174^*$$

$$f_{cu} = \frac{41,174}{1.247} = 33,000 \text{ lb/sq.in.}$$

$$F_{cu} = 45,600 \text{ lb/sq.in. (REF. F25-36-142, PG. II-149)}$$

$$M.S. = \frac{45,600}{33,000} - 1 = +.38$$

ANALYSIS WING  
PREPARED BY SQUIREY  
CHECKED BY Clough  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
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FORT WORTH, TEXAS

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REPORT NO. F25-36-292  
MODEL XB-36  
DATE 5/14/48

## WING BULKHEAD #18

### LOWER CHORD

THIS MEMBER IS CRITICAL IN COMPRESSION, FOR L.A.A. CONDITION, AT THE POINT OF MAX. MOMENT FOR THE MIN. SECTION, WHICH IS 73.2" AFT OF FRONT SPAR. THIS MEMBER IS THE SAME AS THE B-36A LOWER CHORD.

$$h'_v = 33.4"$$

$$h'_t = 23.0"$$

$$h' = h'_v + h'_t = 56.4"$$

$$P_{fl} = 2,965 \text{ lb. in.}$$

REF. F25-36-142

PG. II-139

# 36W118

$$V = -14,100^*$$

$$M = -3,100,000^* \quad \text{REF. PG. 178}$$

$$P = 1690^*$$

$$COT\alpha = 1.15 \quad (\text{REF. F25-36-142, PG. II-14})$$

ASSUMED SAME COT $\alpha$

$$\text{FLANGE LOAD, } P_f = \frac{M}{h'} + P \left( \frac{h_t}{h'} \right) + \frac{V \cot\alpha}{2}$$

$$P_f = \frac{3,100,000}{56.4} + (-1690) \frac{2.3}{56.4} + \frac{14,100 (1.15)}{2} = 69,600^*$$

$$f_{cl} = \frac{69,600}{2,965} = 21,800 \text{ lb./in.}$$

$$F_c = 44,500 \text{ lb./in.} \quad (\text{REF. F25-36-142, PG. II-15})$$

$$M.S. = \frac{44,500}{2,1800} - 1 = +1.04$$

ANALYSIS WING  
PREPARED BY ZONKES  
CHECKED BY Mofford  
REVISED BY \_\_\_\_\_

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FORT WORTH, TEXAS

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WING BULKHEAD #16

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JACKING CONDITION	<u>197</u>
SIDE DRIFT LANDING COND	<u>198</u>
DETAIL ANALYSIS	<u>198</u>

ANALYSIS WING  
PREPARED BY LOWREY  
CHECKED BY Moffatt  
REVISED BY \_\_\_\_\_

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WING BULKHEAD #16

DISCUSSION:

BULKHEAD #16 IS LOCATED 521.5 INCHES FROM THE CENTERLINE OF THE AIRPLANE. IT IS OF THE TENSION FIELD TYPE, CONSTRUCTED ENTIRELY OF ALUMINUM ALLOYS. THE FOUR CONDITIONS THAT HAVE BEEN DETERMINED AS BEING CRITICAL ARE:

- (1) MIN FLYING WT (136,018<sup>#</sup>), L.A.A., UNSYM. GUST, @ 5000'
- (2) MIN. FLYING WT (136,018<sup>#</sup>), ILAA, UNSYM. GUST, @ 5000'
- (3) JACKING CONDITION - O.G.W. (265,192<sup>"</sup>)
- (4) SIDE DRIFT LANDING, ALT 6.4W (112-500<sup>"</sup> FORWARD)

IN ADDITION THE STIFFENERS IN THE OIL TANK REGION ARE CHECKED FOR A TEST PRESSURE OF 7.5<sup>"</sup>/sq.in.

THIS BULKHEAD IS CRITICAL FOR THE SAME CONDITIONS AS BULKHEAD #18. BY COMPARISON OF BULKHEAD #18 LOADS FOR CONDS. (1) AND (2) FOR XB-36 AND B-36A, IT WAS FOUND THAT THERE IS APPROXIMATELY A 35% INCREASE IN LOADS FOR THE XB-36 OVER THE B-36A. THIS SAME PER CENT INCREASE IN LOADS WILL BE ASSUMED FOR BULKHEAD #16 AND THE MARGINS OF SAFETY FOR THESE CONDITIONS WILL BE REDUCED IN

ANALYSIS WING  
PREPARED BY Lowrey  
CHECKED BY Moffit  
REVISED BY \_\_\_\_\_

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WING BULKHEAD #16

DISCUSSION (CONT'D.)

PROPORTION TO THE 35% INCREASE IN LOADS. THE CHORD MEMBERS ARE CRITICAL FOR CONDITIONS (1) AND (2).

MEMBERS CRITICAL FOR CONDITIONS (3) + (4) WILL NOT BE ANALYZED HERE BECAUSE THE XB-36 LOADS ARE SMALLER THAN THE B-36A LOADS AND IT WILL BE CONSERVATIVE TO USE THE B-36A ANALYSIS. THE WEB AND STIFFENERS ARE CRITICAL FOR THESE CONDITIONS.

ANALYSIS WING  
PREPARED BY L. M. REED  
CHECKED BY M. J. STAFFORD  
REVISED BY \_\_\_\_\_

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FORT WORTH, TEXAS

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WING BULKHEAD #16

FLIGHT CONDITIONS:

- (1) MIN. FLYING WT (136,018<sup>2</sup>), L.A.A., UNSYM. GUST, H.S @ 5000 FT.
- (2) MIN. FLYING WT (136,018<sup>2</sup>), I.L.A.A., UNSYM. GUST, H.S @ 5000 FT.

WING BULKHEAD #16 IS CRITICAL FOR THE SAME FLIGHT CONDITIONS AS BULKHEAD #18. BY COMPARISON OF THE SHEARS, BENDING MOMENTS, AND AXIAL LOADS ON BULKHEAD #18 FOR THE B-36A AND XB-36, IT WAS FOUND THAT THERE IS AN INCREASE OF 35% IN LOADS FOR THE XB-36 OVER THE B-36A, FOR M.F.W. (136,018<sup>2</sup>) I.L.A.A. UNSYM. GUST, @ 5000 FT. THIS INCREASE IS DUE PRIMARILY TO THE HIGHER GUST LOAD FACTOR USED IN THE DESIGN OF THE XB-36. THE INCREASE FOR M.F.W. (136,018<sup>2</sup>) L.A.A., UNSYM. GUST, @ 5000 FT. IS SLIGHTLY LESS, BUT WILL BE CONSERVATIVELY ASSUMED TO BE THE SAME, AS THE MARGINS OF SAFETY ARE LARGE. THEREFORE THE LOADS FOR BULKHEAD #16 ON THE XB-36 WILL BE ASSUMED TO INCREASE THE SAME AMOUNT (35%) OVER THE B-36A LOADS.

ANALYSIS WING  
PREPARED BY LOWREY  
CHECKED BY Myers  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
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FORT WORTH, TEXAS

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DATE 5/20/48

## WING BULKHEAD #16

### JACKING CONDITION - D.G.W. (265,192<sup>#</sup>)

NO ANALYSIS WILL BE SHOWN FOR MEMBERS CRITICAL FOR THIS CONDITION, BECAUSE THE DESIGN GROSS WT HAS BEEN REDUCED FROM 278,000<sup>#</sup> ON THE B-36A TO 265,192<sup>#</sup> ON THE XB-36. THE B-36A ANALYSIS WILL BE USED AND CONSIDERED CONSERVATIVE (REF F25-36-142 PG. II-70). THIS CONDITION IS CRITICAL FOR THE WEB AND HORIZONTAL STIFFENERS.

### SIDE DRIFT LANDING COND [A.G.W. (112-500<sup>#</sup> BOMBS)]

THE SIDE DRIFT LANDING CONDITION IS CRITICAL FOR THE BULKHEAD VERTICAL STIFFENERS, AS A RESULT OF FUEL PRESSURES PRODUCED BY THE SIDE INERTIA FACTOR IN THE A.G.W (112-500<sup>#</sup> BOMBS) S.D.L. COND

$$P = \frac{6}{231} \times n_s \times h$$

WHERE :

$n_s = 1.408$  = ULT. AIRPLANE SIDE LOAD FACTOR.  
(REF. F25-36-243, PG. 193)

$h$  = SPANWISE LENGTH OF FUEL CELL.  
(STA. "11" TO STA. "22") = 182"

$$P = \frac{6}{231} \times 1.408 \times 182 = 6.65 \frac{\#}{in}$$

$$P(B-36A) = 6.79 \frac{\#}{in} \text{ (REF. F25-36-142, PG. II-79)}$$

ANALYSIS WING  
PREPARED BY C. Young Jr.  
CHECKED BY M. J. Mafford  
REVISED BY \_\_\_\_\_

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WING BULKHEAD 16

SIDE DRIFT LANDING COND. (CONT'D)

THE XB-36 SIDE DRIFT LANDING CONDITION LOADING IS LESS CRITICAL THAN THE B-36A LOADING; FOR THE CORRESPONDING CONDITION, SO THE B-36A ANALYSIS WILL BE CONSERVATIVELY USED FOR THE XB-36, FOR MEMBERS CRITICAL FOR THIS CONDITION. (REF. F25-36-142, PG II-89)

OIL TANK TEST PRESSURE

THE PORTION OF THE BULKHEAD IN THE OIL TANK REGION IS SUBJECTED TO A TEST PRESSURE OF 7.5  $\frac{1}{2}$  LBS. IN. THIS TEST PRESSURE IS THE SAME AS USED ON THE B-36A, THEREFORE THE B-36A ANALYSIS WILL BE USED FOR THE OIL TANK REGION OF THE BULKHEAD (REF. F25-36-142, PG II-87)

DETAIL ANALYSIS

THE DETAIL ANALYSIS OF THIS BULKHEAD MAY BE DIVIDED INTO THE FOLLOWING PARTS.

- (1) BULKHEAD WEB AND ATTACHMENTS.
- (2) BULKHEAD WEB STIFFENERS.
- (3) BULKHEAD CHORD MEMBERS.

ANALYSIS WING  
PREPARED BY LAWRENCE  
CHECKED BY Snifford  
REVISED BY \_\_\_\_\_

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## WING BULKHEAD #16

### DETAIL ANALYSIS (CONT'D.)

<u>PART</u>	<u>CRITICAL CONDITION</u>
(1) -----	D.G.W. JACKING COND. (FOR DISCUSSION SEE PG 195)
(2) -----	A.G.W. SIDE DRIFT LANDING COND. (112 - 500# BOMBS) (FOR DISCUSSION SEE PG 195)
(3) -----	M.F.W. (136,018 <sup>#</sup> ) I.L.A.A. AND L.A.A., UNSYM. GUST @ 5000 FT. (SEE FOLLOWING CALCULATIONS)

### CHORD MEMBER ANALYSIS

#### UPPER CHORD

THE XB-36 UPPER CHORD MEMBER  
IS THE SAME AS THE B-36A UPPER  
CHORD MEMBER AND IS CRITICAL  
AT THE SAME LOCATION. THEREFORE  
E 36A MARGINS OF SAFETY WILL BE  
RATIOED DOWN FOR THE 35% INCREASE  
IN LOADS FOR THE XB-36 OVER THE B-36A.

(A) M.F.W. (136,018<sup>#</sup>) L.A.A. UNSYM. GUST @ 5000FT  
IS CRITICAL FOR TENSION.

$$M.S.(B-36A) = +1.47 \text{ (FZS-36-142, PG. II-93)}$$

$$M.S.(XB-36) = \frac{(1.47 + 1)}{1.35} - 1 = +\underline{\underline{.83}}$$

(B) M.F.W. (136,018<sup>#</sup>) I.L.A.A. UNSYM. GUST @ 5000FT  
IS CRITICAL FOR COMPRESSION.

$$M.S.(B-36A) = +1.83 \text{ (FZS-36-142, PG. II-94)}$$

$$M.S.(XB-36) = \frac{(1.83 + 1)}{1.35} - 1 = +\underline{\underline{1.09}}$$

ANALYSIS WING  
PREPARED BY LOWE/EX  
CHECKED BY Meffert  
REVISED BY

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## WING BULKHEAD 16

### CHORD MEMBER ANALYSIS (CONT'D.)

#### LOWER CHORD

THE XB-36 LOWER CHORD MEMBER IS THE SAME AS THE LOWER CHORD MEMBER ON THE B-36A AND IS CRITICAL AT THE SAME LOCATIONS. THEREFORE B-36A MARGINS OF SAFETY WILL RATIOED TO THE 35% INCREASE IN LOADS FOR THE XB-36 OVER THE B-36A.

(A) M.F.W. ( $136,018^2$ ) L.A.A. UNSYM. GUST @ 5000FT, IS CRITICAL FOR COMPRESSIVE.

$$M.S. (B-36A) = +1.54 \text{ (FZS-36-142, PG. II-95)}$$

$$M.S. (XB-36) = \frac{1.54+1}{1.35} - 1 = +\underline{.88}$$

(B) M.F.W. ( $136,018^2$ ) I.L.A.A., UNSYM. GUST @ 5000FT IS CRITICAL FOR TENSION.

$$M.S. (B-36A) = +4.41 \text{ (FZS-36-142, PG. II-95)}$$

$$M.S. (XB-36) = \frac{4.41+1}{1.35} - 1 = +\underline{3.01}$$

ANALYSIS Wing  
PREPARED BY Jay  
CHECKED BY Jefford  
REVISED BY

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## BULKHEAD #22 (36W122)

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ANALYSIS Wing  
PREPARED BY J. O. M.  
CHECKED BY S. J. Safford  
REVISED BY \_\_\_\_\_

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BULKHEAD #22 (36W122)

GENERAL DISCUSSION

Bulkhead #22, located at 732.00" from the center-line of the airplane, serves the function of introducing air, inertia, flap fitting, and jack fitting loads into the wing. The bulkhead also acts to stabilize the plate-stringer combination; and serves as the outboard end of the outboard fuel and oil tanks. It is of the web type, and is constructed entirely of aluminum alloys.

Bulkhead #22 (Ref. 36W122) for the XB-36 is essentially the same structurally as Bulkhead #22 (36W4122) for the B-36A. The same conditions that were found critical for the B-36A bulkhead are also critical for the XB-36 bulkhead.

Condition: I - DGW - Flaps Down - Landing Gear Extended

Condition: II - DGW - Jacking Condition

Condition: III-AGW (112-500# Bombs) - Side Drift Landing.

ANALYSIS WING III  
PREPARED BY Doss  
CHECKED BY Campbell  
REVISED BY \_\_\_\_\_

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BULKHEAD NO. 22 GEOMETRY

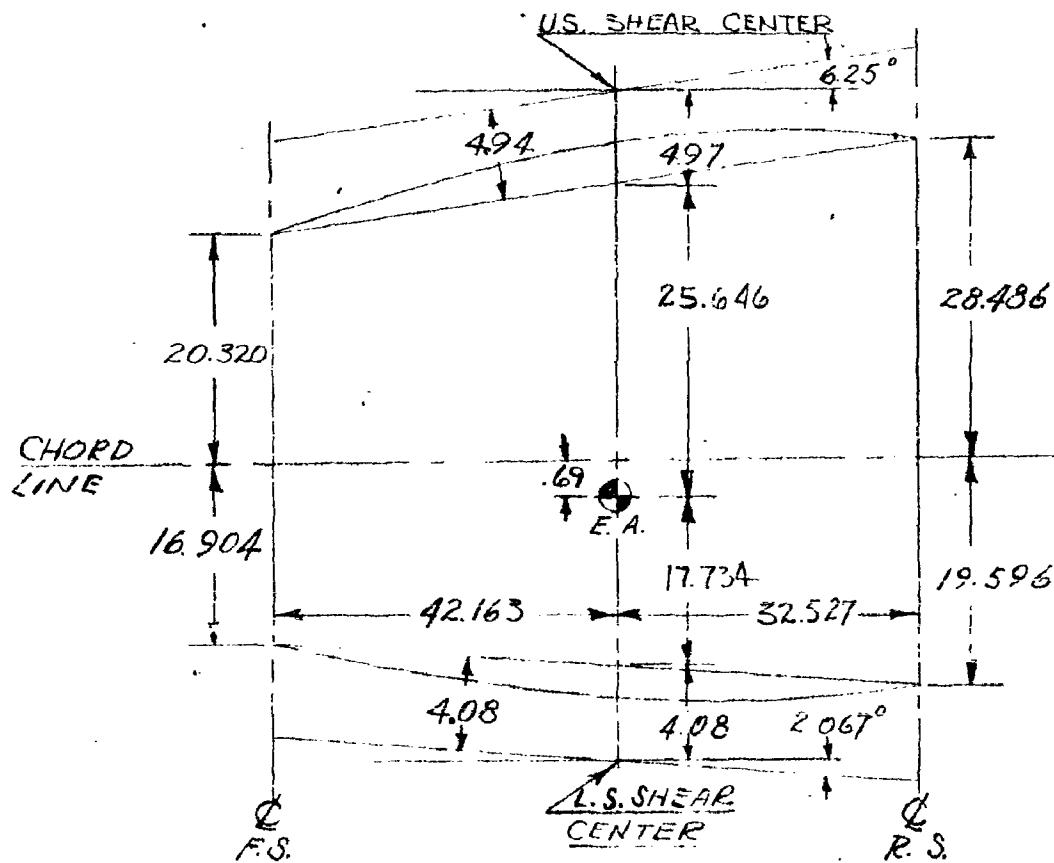


FIGURE 18

ANALYSIS WING RE  
PREPARED BY T.O.S.  
CHECKED BY C. J. Field  
REVISED BY

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CONDITION: I DGW-FD-LGE

LEADING & TRAILING EDGE MOMENTS & SHEARS,  
& FLAP FITTING LOADS ARE CALCULATED IN THE  
SAME MANNER AS FOR THE B-36A.  
(REF. FZS-36-142, P.II-157)

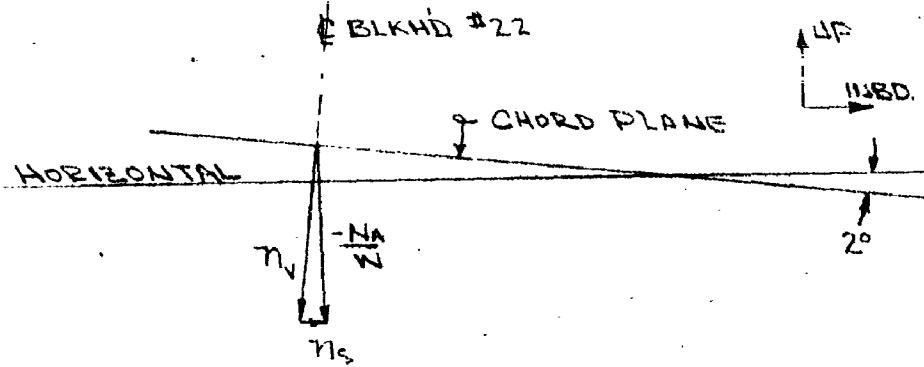
LOAD FACTORS ARE TAKEN FROM FZS-36-126  
P. 85.

LOAD FACTORS

$$-\frac{N_A}{W} = -2.090 \text{ (L TO ROOT CHORD)}$$

$$\frac{X_M}{W} = -.031 \text{ (|| TO ROOT CHORD)}$$

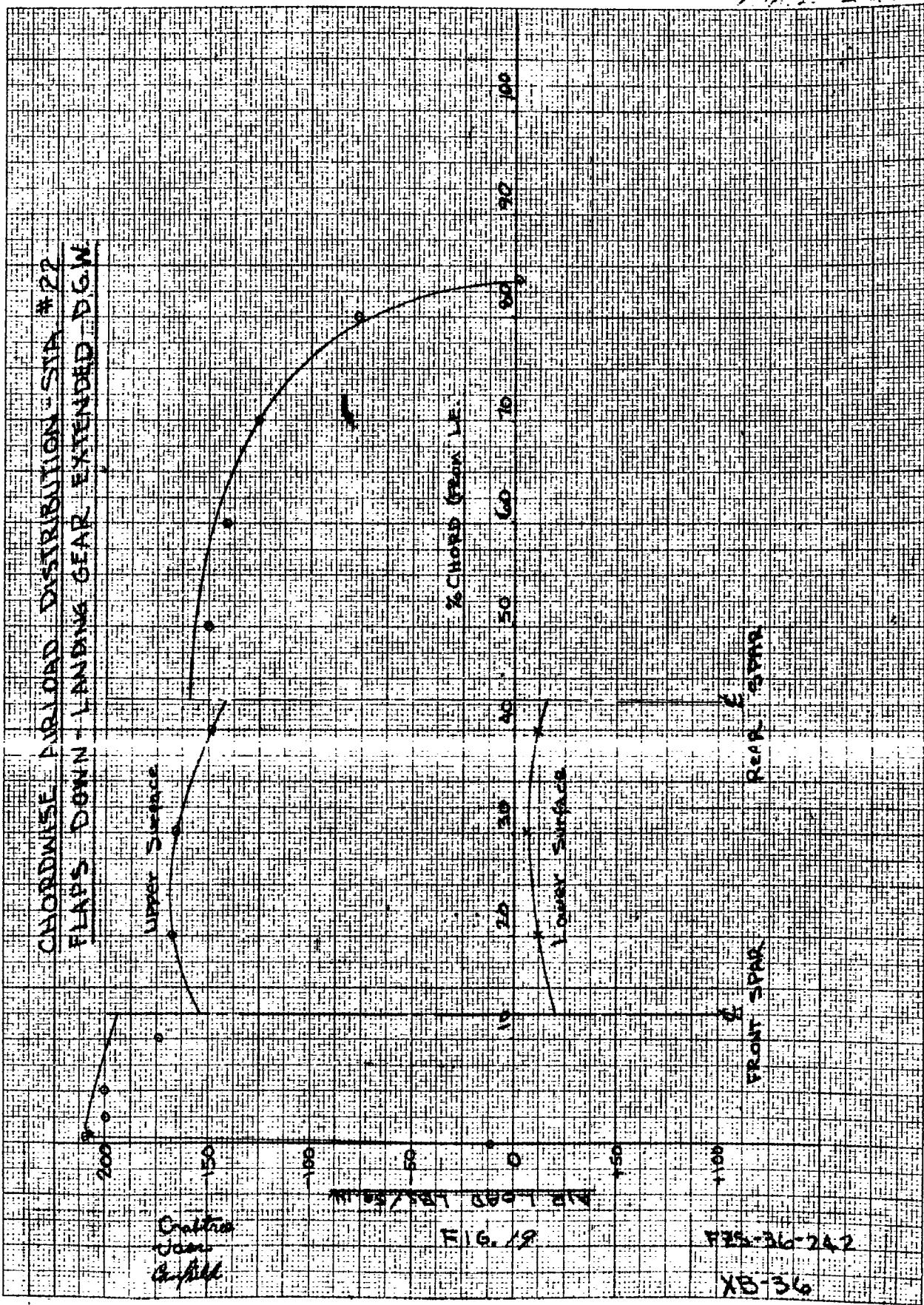
RESOLVING VERTICAL LOAD FACTOR INTO THE  
PLANE OF THE BULKHEAD:



$$n_v = -2.09 \cos 2^\circ = -2.0775$$

$$n_s = -2.09 \sin 2^\circ = -.0718$$

$$n_d = -.031$$



COMPUTATION OF  $M_L$ ,  $N_L$ ,  $M_T$ ,  $M_{T_E}$  FOR ULT. AIRLOADS

D.G.W.-FD-L.G.E.

 $b = 26.44$ ;  $C = 240.734$ ; LE FLAP @ 78.99%PAGE 330  
F25-56-42  
XO-56-42  
DATE 5-48

LEADING EDGE						TRAILING EDGE					
STATION	P %	S.M.	② × ③	MOMENT	ΔM	STATION	P %	S.M.	② × ③	MOMENT	ΔM
% CHED FIG.				MULTIPLIER		% CHED FIG.				MULTIPLIER	
1	2	3	4	5	6	7	8	9	10	11	12
0	-200	1	-200	6	-7200	78.42	-90	1	-90	6	-540
2	-209	4	-836	5	-9180	72.52	-118	4	-472	5	-2360
4	-205	2	-410	4	-1640	66.61	-135	2	-270	4	-1080
6	-201	4	-804	3	-2412	60.71	-144	4	-576	3	-1668
8	-196	2	-392	2	-784	54.81	-150	2	-300	2	-600
10	-190	4	-760	1	-760	48.90	-154	4	-616	1	-616
12	-185	1	-185	0	0	43.00	-156	1	-156	0	0
			-3587		-10976				-2480		-6864

$$\text{ULT. } N_L = \frac{15.6G(-3587 \times .02)}{144} = -2184$$

$$\text{ULT. } N_T = \frac{15.6G(-2480 \times .05903)}{144} = -4.970$$

$$\text{ULT. } M_L = \frac{15.6G(-10976 \times .02)}{144} = -32.200$$

$$\text{ULT. } M_T = \frac{15.6G(-6364 \times .05903)}{144} = -175.000$$

## \* DEFINITION OF TERMS:

 $M_L$  - LEADING EDGE AIRLOAD SHEAR $M_T$  - LEADING EDGE AIRLOAD MOMENT ABOUT F.S. $N_L$  - TRAILING EDGE AIRLOAD SHEAR $M_T$  - TRAILING EDGE AIRLOAD MOMENT ABOUT R.S.

FLAP DOWN 40°

CALCULATED BY: *Brahme*  
CHECKED BY: *Leffel*

## INTERSPAR AIRLOAD SHEARS &amp; MOMENTS

D.G.W.-FD-L.G.E.

PAGE 20  
FD-352442  
10-9-67  
DATE 5-87

FW 533 153 PADS 11-43

STATION % CHORD FIG.	UPPER SURFACE					LOWER SURFACE					
	ORDINATE IN. #	SIMPSON'S MULTIPLIER (2) X (3)	MOMENT MULTIPLIER (4) X (5)			STATION % CHORD FIG.	ORDINATE IN. #	SIMPSON'S MULTIPLIER (2) X (3)	MOMENT MULTIPLIER (10) X (11)		
1	2	3	4	5	6	7	8	9	10	11	12
12	155	1	155	6	930	12	35	1	35	6	210
17.17	104	4	656	5	3280	17.17	20	4	80	5	480
22.83	167	2	334	4	1236	22.83	10	2	20	4	80
27.50	165	4	640	3	198	27.50	7	4	28	3	84
32.66	160	2	320	2	640	32.66	8	2	16	2	32
37.83	152	4	608	1	648	37.83	11	4	44	1	44
43	142	1	192	0	0	43	17	1	17	0	
	E <sub>4</sub>		2872	E <sub>4</sub>	8774		E <sub>10</sub>		240	E <sub>12</sub>	850

$$M_{\text{ult}} = \frac{1}{144} \left[ \sum_{i=1}^{12} \left( \frac{\text{Ord}_i}{6} \right)^2 \times \left( \frac{31}{6} \right) \times 1 \right] = 171,800^{\prime\prime} \text{ (ULTIMATE)}$$

$$M_{\text{ult}} = 16680^{\prime\prime} \text{ (ULTIMATE)}$$

45.0°

EQUIVALENT  
TRAPEZOIDS

64.1%

UPPER SURFACE

E.R.S.

57.1%

E.R.S.

7.8%

E.F.S.

44.1%

E.R.S.

378°

CALCULATED BY: Esholtz

CHECKED BY: [Signature]

ANALYSIS WING II  
PREPARED BY J.O.S.  
CHECKED BY Canfield  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

PAGE 208  
REPORT NO. FZS-36-242  
MODEL XB-36  
DATE 4-48

CONDITION: I DWI-FD-LGE

AIR LOADS  
LEADING EDGE

$$N_L = 2184^*$$

$$M_L = 32200^* \curvearrowleft$$

" $M_L$ " AS A COUPLE AT UPPER & LOWER  
SURFACES =  $\frac{32200}{37.124} = 865^* \rightleftarrows$

TRAILING EDGE

$$N_T = 4,470^*$$

$$M_T = 175,000^* \curvearrowright$$

" $M_T$ " AS A COUPLE AT UPPER & LOWER  
FITTINGS =  $\frac{175,000}{43.925} = 3980^* \rightleftarrows$

INTERSPAR AIR LOAD

$$\text{UPPER SURFACE} = 4,520^*$$

$$\text{LOWER SURFACE} = 378^*$$

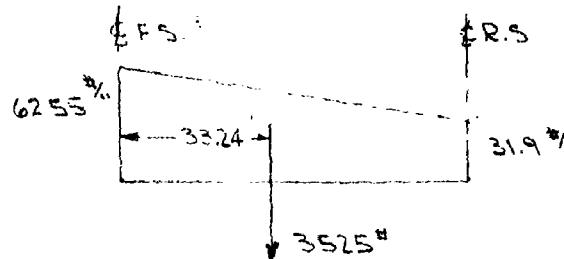
FUEL & OIL LOADS

$$1G \text{ LOAD} = 1132.8 \text{ AT } 25.75\% \text{ CHORD}$$

(REF. TABLE 16, P.52, FZS-36-240)

$$\text{ULTIMATE LOAD} = 1132.8 \times 2.0775 \times 1.5 = 3,525^*$$

A TRAPEZOIDAL DISTRIBUTION OF COMBINED  
FUEL & OIL LOADS IS ASSUMED.



ANALYSIS WING III  
PREPARED BY Jose  
CHECKED BY Canfield  
REVISED BY

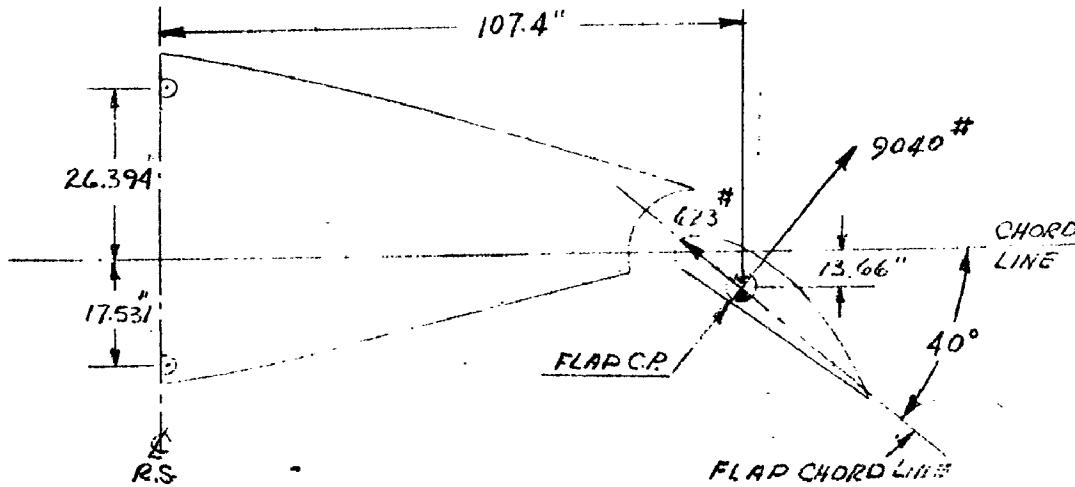
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REPORT NO. FZS-36-247  
MODEL XB-36  
DATE 4-48

COND: I DGW-FD-LGE

FLAP LOADS ARE THE SAME AS FOR THE B-36A

(FLAP LOADS TAKEN FROM FZS-36-148, P 36)



RESOLVING LOADS OF FIG. ABOVE INTO VERTICAL  
& HORIZONTAL COMPONENTS

$$V = 9040 \sin 40^\circ + 7325 \sin 40^\circ = 7325^\#$$

$$D = 9040 \sin 40^\circ - 623 \cos 40^\circ = 5333^\#$$

$$M_{RS} = 7325 \times 107.4 = 787,000^\#$$

"M" AS A COUPLE AT UPPER & LOWER FITTINGS:

$$\frac{787,000}{43.925} = 17,900^\#$$

DRAG LOAD BEAMED TO UPPER & LOWER FITTINGS.

$$D_U = \frac{3.871 \times 5333}{43.925} = 468^\#$$

$$D_L = \frac{40.054 \times 5333}{43.925} = 4865^\#$$

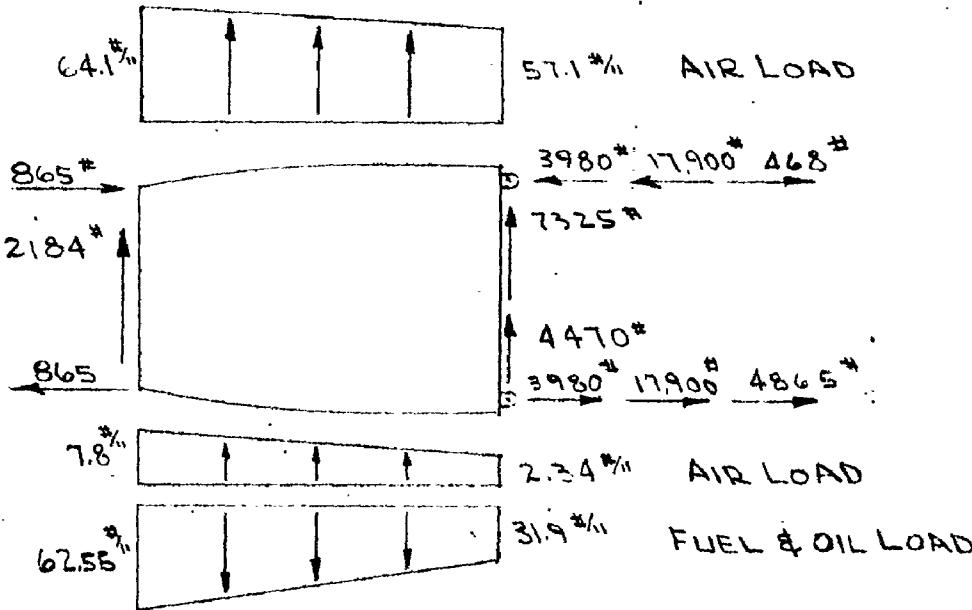
ANALYSIS WING III  
PREPARED BY Voss  
CHECKED BY Cawfield  
REVISED BY

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FORT WORTH, TEXAS

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REPORT NO. FZS-36-2A2  
MODEL XB-36  
DATE 4-48

COND: I DGW-FD-LGE

SUMMARY OF APPLIED LOADS ON BULKHEAD



TRANSFERRING LOADS TO THE END OF THE BULKHEAD

$$D = 4865 + 468 \text{ (AFT)}$$

$$V = 2184 + 378 + 4250 + 7325 - 3525 + 4470 = 15352 \text{ (#UP)}$$

$$\begin{aligned} T_EA. &= 32,200 + 2184(42.163) - 175,000 - 4470(32.527) \\ &\quad - 5333(12.97) - 7325(139.927) - 3525(8.923) \\ &\quad + 4520(5.473) + 378(11.573) \\ &= -1,292,205 \text{ "#} \uparrow \end{aligned}$$

REACTING THE TORSION ABOUT THE ELASTIC  
AXIS AS A SHEAR FLOW AROUND THE BLKHD:

$$q = \frac{T}{2A} = \frac{-1292,205}{2(3526.2)} = 183.2 \text{ "#}/\text{in}$$

ANALYSIS WING II  
PREPARED BY Voss  
CHECKED BY Campfield  
REVISED BY

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PAGE 2/1  
REPORT NO. EZB-36-242  
MODEL XP-36  
DATE 4-48

COND: I DGW-FD-LGE

REACTING DRAG FORCE AT UPPER & LOWER  
SHEAR CENTERS:

$$R_U = 5333 \times \frac{21814}{52.430} = 2220^*$$

$$R_L = 5333 \times \frac{30616}{52.430} = 3113^*$$

$$q_{U} = \frac{2220}{74.69} = 29.7^{\text{#/in}} (\text{FWD.})$$

$$q_L = \frac{3113}{74.69} = 41.6^{\text{#/in}} (\text{FWD.})$$

THE VERTICAL COMPONENT OF UPPER & LOWER  
SURFACE SHEAR IS:

$$V_U = 2220 \times \tan 6.25^\circ = 2220 \times .1093 = 242^* (\text{UP})$$

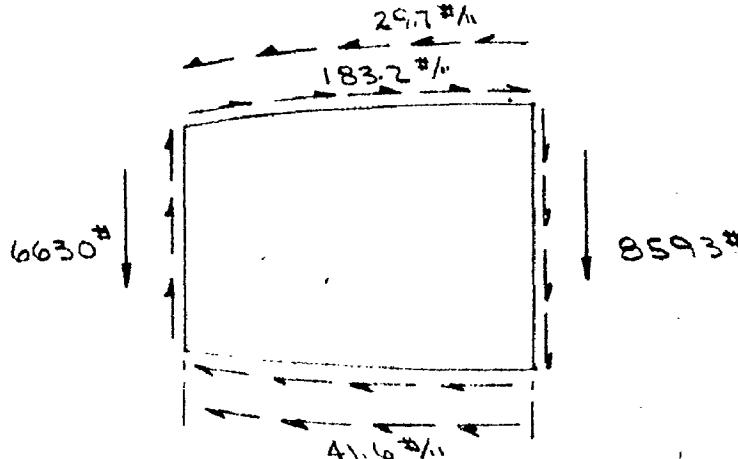
$$V_L = 3113 \times \tan 2.067^\circ = 3113 \times .0361 = 112.5^* (\text{DOWN})$$

REACTING VERTICAL SHEAR AT FRONT & REAR SPARS:

$$R_{F.S.} = (-15,352 + 242 - 112.5) \frac{32.527}{74.690} = -6630^* (\text{DOWN})$$

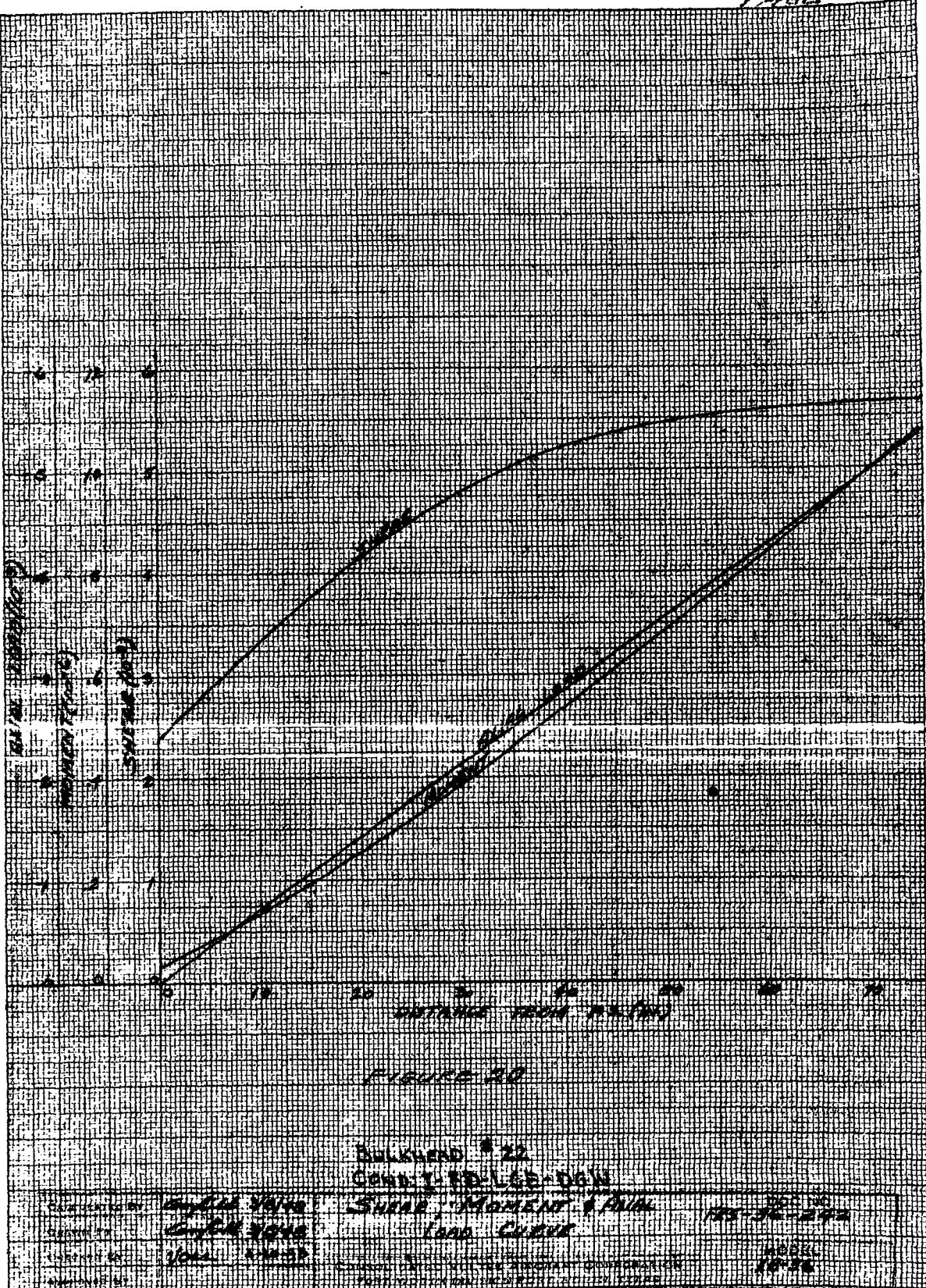
$$R_{R.S.} = (-15,352 + 242 - 112.5) \frac{42.163}{74.690} = 8593^* (\text{DOWN})$$

SUMMARY OF BULKHEAD REACTIONS:





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ANALYSIS Wing  
PREPARED BY Worrell  
CHECKED BY Mofford  
REVISED BY \_\_\_\_\_

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BULKHEAD #22

DETAIL ANALYSIS

Web Analysis

The critical bulkhead shear occurs in  
Condition: II - D.G.W. - Jacking

The jacking loads vary directly with the weight of the airplane, assuming no appreciable change in airplane c.g., and as the DGW for the XB-36 is less than the DGW for the B-36A, the jacking loads will be less for the XB-36. Margins of safety for the bulkhead web, web attachments, and web splice are all greater than 100% for the B-36A. (Ref. FZS-36-142, P. II-177 to II-180). XB-36 margins of safety for the web, web attachments, and web splice may be conservatively obtained from the foregoing reference.

Stiffener Analysis

Stiffeners in Engine Oil Tank Area

XB-36 bulkhead stiffeners in the engine oil tank area are designed to the same test pressure as B-36A stiffeners. See FZS-36-142, P. II-182 for margins of safety.

Vertical Stiffeners in Fuel Tank Area

The vertical stiffeners in the fuel tank area are designed primarily by fuel pressure from the AGW-Side Drift Landing Condition. The side inertia factor has been reduced from 1.434 AGW-(112-500# Bombs) Side Drift Landing for the B-36A (Ref. FZS-36-141 P. 284) to 1.408 AGW (112-500# Bombs) Side Drift Landing for the XB-36 (Ref. FZS-36-243 P.143). The values of the stiffener stresses in Table II-XL, P. II-191 (Ref. FZS-36-142) will be 1.437/1.408 or 2% conservative for the XB-36. The minimum stiffener margin of safety for the B-36A is +55%. Margins of safety for the XB-36 will exceed this value.

ANALYSIS Wing

PREPARED BY Von  
CHECKED BY Mofford  
REVISED BY \_\_\_\_\_

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MODEL XB-36  
DATE 4-22-48

Stiffener Analysis (Cont'd.)

Horizontal Stiffeners in Panel Adjacent  
To Front Spar

These stiffeners are loaded by the tension field action of the bulkhead web and are critical for DGW-Jacking. Margins of safety for B-36A stiffeners are conservatively taken for XB-36 stiffeners by the same analogy made for the bulkhead web analysis. (Ref. FZS-36-142, P. II-180).

ANALYSIS Wing  
PREPARED BY JOM  
CHECKED BY Mefford  
REVISED BY

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ANALYSIS OF CHORD MEMBERS

Upper Chord Member

The maximum moment occurs at the R.S. in the DGW-Flaps Down-Landing Gear Extended Condition.

The compressive load is:

$$P_c = \frac{M}{h'} + \frac{S_{tu} \cot \alpha}{2} + P_A \quad (\text{Ref. AAF TR 4313; P. 257 EQ. 11-38})$$

$$S_{tu} = S - S_{cR}$$

Comparing loads for B-36A and XB-36 Airplanes:

B-36A  
Ref. FZS-36-142  
P. II-167

XB-36

$$S = 5431\#$$

$$S = 5647\#$$

$$M = 1,044,250"\#$$

$$M = 1,073,300"\#$$

$$P_A = -5333\#$$

$$P_A = -5330\#$$

The comparison indicates very little increase in stress for the upper chord member. The margin of safety for the B-36A upper chord is greater than 100%. The margin of safety for the XB-36 upper chord can be taken as that of the B-36A.

Lower Chord Member

Since the B-36A lower chord member has a high margin of safety its margin of safety can be said to apply to the XB-36.

ANALYSIS WING  
PREPARED BY Myfford  
CHECKED BY \_\_\_\_\_  
REVISED BY \_\_\_\_\_

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WING BULKHEAD #23  
(36W123)

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ANALYSIS Wing

PREPARED BY Effort

CHECKED BY \_\_\_\_\_

REVISED BY \_\_\_\_\_

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FORT WORTH DIVISION

FORT WORTH, TEXAS

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XB-36

MODEL \_\_\_\_\_

DATE 4-7-48

WING BULKHEAD #23

DISCUSSION

Wing Bulkhead #23 is located 766" from the center line of the airplane. The bulkhead introduces airload, inertia loads, and engine mount fitting loads into the wing; it also resists crushing loads and stabilizes the plate stringer combinations. The bulkhead is of combined web and truss type construction, made entirely of aluminum alloys.

Two conditions are critical for the bulkhead members.

1. Min. Flying Wt. (136,018#) LAA, Positive Unsymmetrical Gust @ 5,000'
2. Minimum Flying Wt. (136,018#) ILAA, Negative Unsymmetrical Gust @ 5,000'

All loads applied to the bulkhead other than air loads are based on the factors produced by the unsymmetrical loading condition, Ref. FZS-36-253, page 4. The air load is the same as for the symmetrical gust condition since it is necessary to have 100% of the air load in the negative gust condition factors increased by the rolling moment.

The rear spar vertical is critical for the AGW (72-1,000# Bomb) LAA @ 35,000' condition. The applied bulkhead loads for this condition are obtained as shown on page 270.

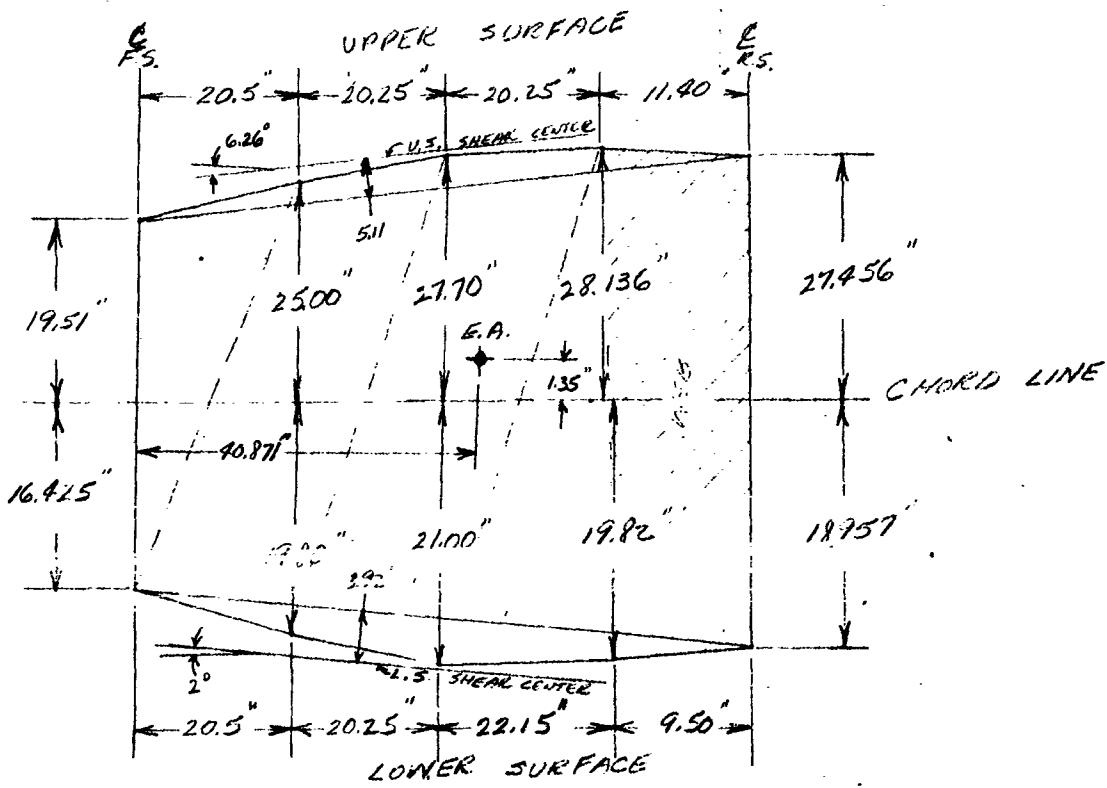
ANALYSIS WING  
PREPARED BY LAWREY  
CHECKED BY M. L. ORO  
REVISED BY \_\_\_\_\_

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DATE \_\_\_\_\_

WING BULKHEAD #23

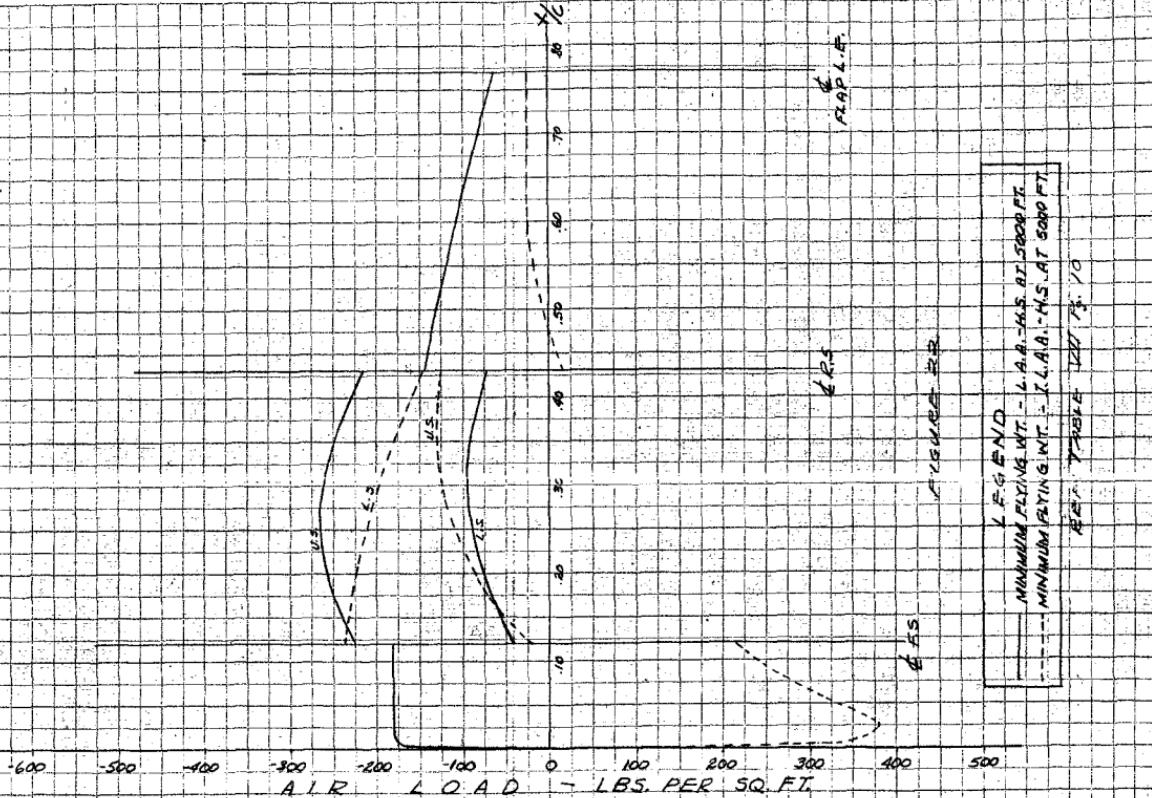
BULKHEAD DIMENSIONS



TOTAL ENCLOSED AREA = 6616 sq. IN.

FIGURE 21

CHORDWISE AIRLOAD DISTRIBUTION  
WING STATION #23



CALCULATED BY  
DRAWN BY  
CHECKED BY  
APPROVED BY

Rogers MWT  
Survey 4/18  
FIGURE  
CHORDWISE AIRLOAD DIST.  
STATION #23  
CONSOLIDATED VULTEE AIRCRAFT CORPORATION  
FORT WORTH DIVISION, FORT WORTH, TEXAS

DOCTRED  
FEB 30 2022  
MODEL  
XB-36

KERSEY FERRIN CO. H.A.  
PUGH 220

BASIC MT. POINT	I-G VERTICAL LOAD ON BASIC MOUNT (ACTING DOWN)			I-G SIDE LOAD* ON BASIC MOUNT (ACTING INBOARD)			I-G DRAG LOAD* ON BASIC MOUNT (ACTING AFT)								
	V	D	S	V	D	S	V	D	S						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)						
A	11807	+6227	+858	+925	+434	+734	-135	+1244	+193	E BURNHD *29 ON L.H. SIDE OF SHIP	E BURNHD *43 ON R.H. SIDE OF SHIP	E BURNHD *23 ON R.H. SIDE OF SHIP			
A'	+1807	+6227	+858	+925	+434	+734	-135	+1244	+193						
C	+1666	-6233	+860	+224	+15018	+2756	+142	+2252	+295						
C'	+1666	-6233	+860	+224	+15018	+2756	+142	+2252	+295	A +	+A'				

\* REF F25-36-253 ADD.

TABLE VIII, PG. 69

DETAIL SHOWING LETTER DESIGNATION  
OF BASIC ENG MT. POINTS

### SIGN CONVENTION & DIRECTION OF LOADS

VIEW LOOKING FWD NORMAL TO ENGINE  
MOUNT FITTING PLATE

VERTICAL LOADS ARE NORMAL TO THE CHORD  
PLANE & (+) WHEN DIRECTED DOWN.

DRAG LOADS ARE PARALLEL TO THE E OF  
THRUST & (+) WHEN DIRECTED AFT.

SIDE LOADS ARE PARALLEL TO THE CHORD  
PLANE & NORMAL TO THE E THRUST & ARE (+)  
WHEN DIRECTED INBOARD.

IN THE COLUMNS WHERE THE LOADS  
APPEAR WITH BOTH (+) & (-) SIGNS THE  
TOP SIGNS ARE FOR LOADS THAT OCCUR  
ON THE L.H. SIDE OF THE AIRPLANE;  
BOTTOM SIGNS, FOR THOSE OCCURRING ON  
THE R.H. SIDE. SINGLE SIGNS ARE FOR  
LOADS THAT OCCUR ON BOTH SIDES.

PREPARED BY: VOSS 10/09/67  
CHECKED BY: JOHNSON 11/3/67

TABLE XIX

BASIC MT. POINTS	$\leftarrow N_y = 6,872 \text{ DOWN} \rightarrow$						$\leftarrow N_x = 241 \text{ INBD} \rightarrow$						$\leftarrow N_o = 0.925 \text{ AFT} \rightarrow$						ULTIMATE TORQUE* ON BASIC MOUNT *			ULTIMATE TORQUE* ON BASIC MOUNT			TOTAL LOADS		
	V	D	S	V	D	S	V	D	S	V	D	S	V	D	S	V	D	S	ZV	ZD	ZS						
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)					
NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN	NN					
Bob (2) T-36-14	Bob (3) T-36-14	Bob (4) T-36-14	Bob (5) T-36-14	Bob (6) T-36-14	Bob (7) T-36-14	Bob (8) T-36-14	Bob (9) T-36-14	Bob (10) T-36-14	Bob (11) T-36-14	Bob (12) T-36-14	Bob (13) T-36-14	Bob (14) T-36-14	Bob (15) T-36-14	Bob (16) T-36-14	Bob (17) T-36-14	Bob (18) T-36-14	Bob (19) T-36-14	Bob (20) T-36-14	Bob (21) T-36-14	Bob (22) T-36-14	Bob (23) T-36-14						
A	+12,910	+42,700	-5890L	-223L	+104L	+177	-2	+14	-24	-4773L	-12,936L	+12,924L	+64	-1135	+158L	+12,185L	+42,884L	-5715L									
			+5890E	+223R	-104R				+2K	-4773R	+12,936R	-12,924R		-158R		+12,631R	+42,600R	-100,674R									
A'	+12,910	+42,700	+5890L	+223L	-104L	+177	-2	+14	+64	+4773L	+12,936L	-12,924L	+64	-1135	-158L	+17,468L	+53,714L	+172,33L									
			+5890R	+223R	-104R				-2K	+4773R	+12,936R	-12,924R		+158R		+17,028R	+53,714R	-6779R									
C	+11,930	+42,700	+5910L	-54L	+1362L	+664	+2	+26	-3L	-4032L	+12,985L	-12,984L	-69	-1605	+221L	+13,371L	+39,594L	+165,714L									
			+5910R	+54R	-3620R				+3K	-4032R	+12,985R	-12,984R		-221R		+11,468R	+42,394R	+52,93R									
C'	+11,930	+42,700	-5910L	+54L	-3620L	+664	+2	+26	+3L	+4032L	-12,985L	-12,984L	-69	-1605	-221L	+15,374L	+60,346L	+67,62L									
			+5910R	-54R	+3620R				-3K	+4032R	-12,985R	-12,984R		+221R		+15,374R	+53,104R	+80,76R									

CONDITION: MIN. FLYING WIT: 136.018\*-UNSYMM. GUST-LAT. @ 5000'

$\leftarrow N_y = 3,587 \text{ UP} \rightarrow$   $\leftarrow N_x = 0.83 \text{ OUTBD} \rightarrow$   $\leftarrow N_o = 0.925 \text{ AFT} \rightarrow$

A	-6990	-22,350	+3080L	+77L	-36L	-61	-3	+74	-4L	-4773L	-12,936L	+12,922L	+64	-1135	+158L	+11,135L	+35,938L	+4,9495L			
			-3080R	-77R	+36R				+4L	-4773R	-12,936R	+12,922R		-158R		+11,779R	+35,461R	+4,617R			
A'	-6990	-22,350	-3080L	-77L	+36L	-61	-3	+74	+4L	+4773L	+12,936L	+12,922L	+64	-1135	-158L	-6,570L	+22,200L	+3,172L			
			+3080R	+77R	-36R				-4L	+4773R	+12,936R	+12,922R		+158R		+6,916R	+22,362R	+3,015R			
C	-5980	+22,900	+3085L	+19L	-285L	-228	+3	+93	-6L	-4032L	+12,985L	-12,984L	-69	-1605	+221L	+10,054L	+32,038L	+4,396L			
			+3085R	-19R	+285R				+6L	-4032R	+12,985R	-12,984R		-221R		+10,054R	+32,038R	+3,980R			
C'	-5980	+22,900	+3085L	-19L	+285L	-228	+3	+93	+6L	+4032L	-12,985L	+12,984L	-69	-1605	-221L	+59,96L	+23,684L	+2,863L			
			+3085R	+19R	-285R				-6L	+4032R	-12,985R	+12,984R		+221R		+59,58R	+21,198R	+3,19R			

#### SIGN CONVENTION

- (+) VERTICAL LOADS, DOWN
- (+) DRAG LOADS, AFT
- (+) SIDE LOADS, INBD.

L DESIGNATES L.H. MOUNT  
R DESIGNATES R.H. MOUNT

PREPARED BY: VOLS 1/2/67  
CHECKED BY: JOHNSON 11/3/67

\* THESE LOADS DUE TO TORQUE ARE FOR A .29 GEAR RATIO  
INSTEAD OF A .38 GEAR RATIO, AND ARE THEREFORE CONSERVATIVE.

ANALYSIS WING  
PREPARED BY Johnson  
CHECKED BY Chapfield  
REVISED BY \_\_\_\_\_

## Consolidated Vultee Aircraft Corporation

FORT WORTH DIVISION  
FORT WORTH, TEXASPAGE 223  
REPORT NO. F25-36-242  
MODEL XB-36  
DATE 11/4/47WING BULKHEAD #23ENGINE MOUNT FITTING LOADS

THESE ARE APPLIED LOADS TO THE  
ENGINE MOUNT FITTINGS.(REF. PG. 222.)

MIN. FLYING WT. (136,018") L.A.A. UNSYNA. GUST 5000'

	V	D	S
UPPER FITTING	-17,468	53,911	7233
LOWER FITTING	-15,449	-60,344	-6762

MIN FLYING WT (136,018") ILAA. UNSYM. GUST 5000'

	V	D	S
UPPER FITTING	11,279	-35,861	-4611
LOWER FITTING	10,097	34,528	3940

VERTICAL; POSITIVE WHEN UP - NORMAL TO  
THE CHORD PLANE.

DRAG; POSITIVE WHEN AFT - PARALLEL TO  
THE C OF THRUST AND IN THE  
CHORD PLANE.

SIDE; POSITIVE WHEN INBOARD - PARALLEL  
TO THE CHORD PLANE & NORMAL TO  
THE C OF THRUST.

ANALYSIS WING  
PREPARED BY Lowrey  
CHECKED BY Canfield  
REVISED BY

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FORT WORTH DIVISION  
FORT WORTH, TEXAS

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WING BULKHEAD #23

CONDITION

MIN. FLYING WT (136,018<sup>4</sup>) L.A.A. UNSYM.  
GUST @ 5000'

ANALYSIS WING  
PREPARED BY Russell  
CHECKED BY Campfield  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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DATE 11/30/47

## WING BULKHEAD #23

CRUSHING LOADS (MFW, L.A.A. UNSYM GUST @ 5000')

$M'_x$  ASSUMED EQUAL TO  $M_x$

$M_x = 23,760,000$ " (OBTAINED FROM PRELIMINARY)  
CALCULATIONS,

$$P_{cr} = \frac{(M_x)^2}{(I_x/E)EI} L$$
$$\left. \begin{aligned} I_x &= 22,660 \text{ in.}^4 \\ Q_x &= 515.24 \text{ in.}^3 \\ L &= 37.0 \text{ in.} \\ E &= 10,300,000 \end{aligned} \right\} \begin{array}{l} \text{F25-36-142} \\ \text{pg. II-201} \end{array}$$

$$P_{cr} = \frac{(23,760,000)^2 (37)}{\left(\frac{22,660}{515.24}\right) 10.3 \times 10^6 \times 22,660} = 2030^*$$

CRUSHING LOAD WILL BE DISTRIBUTED IN PROPORTION TO SPAR DEPTHS.

F.S. = 35.935

R.S. = 46.413

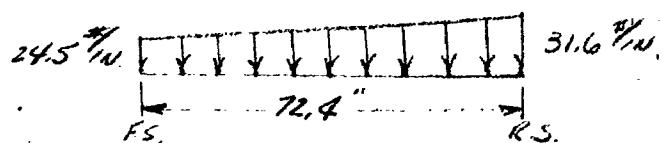
2182.348

41.174 AVERAGE SPAR DEPTH.

$$\frac{2030}{72.4} = 28.05^{\text{th}}/\text{in} \text{ AV. LOADING OVER CHORD}$$

$$\text{AT F.S.}, w = \frac{35.935}{41.174} (28.05) = 24.5^{\text{th}}/\text{in}$$

$$\text{AT R.S.}, w = \frac{46.413}{41.174} (28.05) = 31.6^{\text{th}}/\text{in}$$



WING BULKHEAD #23  
SHEARS & BENDING MOMENT AT REAR STAR FROM T.C. AIRLOAD  
COND: M.E.M. & A.D. DUE TO GUST @ 5000 FT.

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% SPAN (%)	DIST FROM N.S. (ft)	DIST BETWEEN STA (ft)	P(GA)	P(AU)	25 INCHES 6-51'	S (LMT)	DIST FROM STA TO CENTROID	1.25	0.12	M <sub>T</sub> (lb-in)	S (ULT)	M (ULT)	
								(1)	(2)	(3)	(4)	(5)	
					3M 5-13	36	0X(9)	0X(9)	0X(9)	0X(9)	0X(9)	0X(9)	
.679	58.16	-88				0		0	0	0	0	0	
.650	51.39	-95	-92	-160		3.35							
.625	45.55	5.84	-99	-189		-160		-536	0	-536	-240	-805	
.600	39.71	5.84	-102			-309		-431	-785	-1902	-463	-2850	
.575	33.87	5.84	-108			-467		-457	-1810	-4167	-700	-6280	
.550	28.03	5.84	-111			-634		-487	-2730	-7386	-950	-11100	
.525	22.19	5.84	-118			-808		-505	-3100	-11591	-1210	-17400	
.500	16.35	5.84	-122	-183		2.89		-527	-4720	-16880	-1490	-25200	
.475	10.51	5.84	-125			-991		-557	-5790	-23187	-1780	-34700	
.450	4.67	5.84	-133	-180		2.90		-580	-6490	-30707	-2070	-96000	
.430	0	5.84	-135			-1383		-600	-8100	-39407	-2340	-54100	
			-140			-207		-633					
			4.67			-142		-1760		-396	-7420	-47223	-2690
			-143										-70,200

$$C = 233,546 \text{ IN}$$

$$b = 37.00 \text{ IN}$$

PREPARED BY: RUSSELL  
CHECKED BY: Campfield

WING BULKHEAD #23  
SHEARS AND BENDING MOMENT AT FRONT SPAN FROM L.E. AIRLOAD  
COND. M.F.W. L.G.A. UNKNOWN GROSS 5300 FT.

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TABLE XVII

%	DIST. FROM FS. (in.)	DIST. BETW. STA (in.)	P(STA)	P(in.)	ΔS 0=700 (in.)	S 0=700 (in.)	DIST. STO TO CENTROID (in.)	ΔM <sub>1</sub>		M <sub>T</sub> (in.)	S. (in.)	M <sub>T</sub> (in.)
								(1)	(2)			
								3X(6)	1X(6)			
								3X(6)	1X(6)			
0	28.12	0			0	0	0	0	0	0	0	0
.02	23.95	4.67	-180	-90	-120	2.26	-187	0	-187	-180	-280	
.04	18.78	4.67	-182	-181	-217	2.34	-508	-560	-1255	-506	-1880	
.06	14.11	4.67	-182	-182	-219	2.34	-512	-1575	-3342	-834	-5080	
.08	9.34	4.67	-182	-182	-219	2.34	-512	-2600	-6554	-1163	-9880	
.10	4.67	4.67	-182	-182	-219	2.34	-512	-3620	-10,586	-1993	-16,000	
.12	0.	4.67	-182	-182	-217	2.34	-512	-4620	-15,738	-1821	-23,600	

C = 233.546  
L = 37.00"

PREPARED BY: RUSSELL  
CHECKED BY: Campbell

TABLE  
XLVIII

WING BULKHEAD # 23  
INTERSPAR AIRLOAD  
COND: M.A.W. LAA UNSVM GUST @ 6000'

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XBS-36

	% CHORD (%)	DIST. BETW. STA.	$P_{(av)}$	$D_5$ $b=37'$	$S$ (LIMIT)	DIST. FROM STA. TO C.G.	$Q_M$	$Q_M_2$	MT (LIMIT)	$S$ (ULT)	M (ULT)				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)			
				$37.02 \times (4)$	$29$		$(5) \times (7)$	$(2) \times (6)$	$(2) \times (8) + (9)$						
UPPER SURFACE	.12	-225			0										
	.15	7.00	-232	-418	-418	3.47	-1250	0	0						EQUIV. TRAPEZOIDAL LOADING
	.20	11.68	-238	-744	-744	5.76	-9280	0	-1950						
	.25	11.68	-257		-1162	5.80	-8560	-9870	-10620						
	.30	11.68	-262	-786	-786	5.85	-9630	-13600	-28780	98.1% IN.					
	.35	11.68	-264	-792	-792	5.88	-9510	-22700	-56110						
	.43	11.68	-255	-763	-763	5.89	-4510	-32000	-72620						
	.43	18.68	-248		-3505	9.55	-10620	-65500	-168780	-6926	-253110				
LOWER SURFACE	.12	7.00	-93		0	3.34	-301	0	0						EQUIV. TRAPEZOIDAL LOADING
	.15	11.68	-57	-50	-90	-90		0	-301						
	.20	11.68	-67	-201	-201	5.56	-1120						F.S.	-72.4"	R.S.
	.25	11.68	-77	-291	-291	5.69	-1440	-1050	-2871						
	.30	11.68	-90	-252	-252	5.79	-1440	-3400	-7311						
	.35	11.68	-93	-279	-279	5.79	-1620								
	.43	11.68	-95	-282	-282	5.82	-1660	-6350	-15281						
	.43	18.68	-92	-282	-1104	5.88	-1660	-7600	-26541						
				-394		9.72	-3830								
				-1498			-20600	-50971	-2247716457						

PREPARED BY: RUSSELL  
CHECKED BY: Campbell

ANALYSIS WING  
PREPARED BY RUSSELL  
CHECKED BY Campfield  
REVISED BY

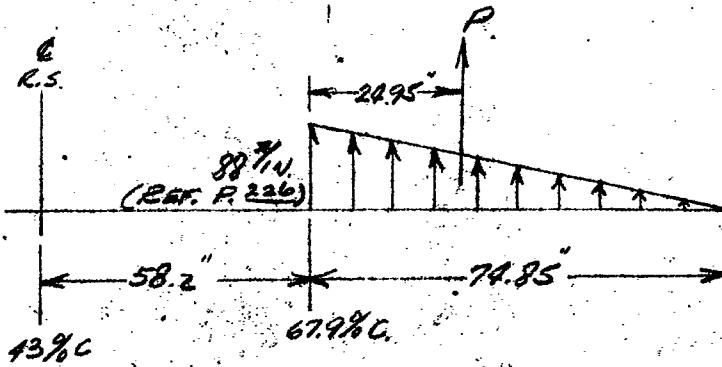
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FORT WORTH, TEXAS

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DATE 10/30/47

WING BULKHEAD #23

NACELLE AIR LOAD

SEE DISCUSSION ON PG II-97, F25-36-142.



$$P_{(VLT)} = 1.5 \left( \frac{0.13}{2} \times \frac{74.85}{12} \times \frac{37.425}{12} \right) = 1270^*$$

THIS LOAD IS INTRODUCED AS A COUPLE AT THE ENGINE MT. FITTINGS AND AN EQUAL SHEAR ON EACH FITTING.

$$\text{COUPLE} = 1270 \times \frac{74.85}{49.5} = 1990^* \rightarrow$$

$$\text{SHEAR} = \frac{1270}{2} = 635^* (\text{UP})$$

ANALYSIS WING  
PREPARED BY Russell  
CHECKED BY Enfield  
REVISED BY

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## WING BULKHEAD #23

### L.E. & T.E. AIRLOADS

$$L.E. \text{ SHEAR} = 1821^{\#} (\text{UP})$$

$$L.E. \text{ MOM}_F.S. = 23600^{\prime\prime} (\text{CLOCKWISE})$$

$$T.E. \text{ SHEAR} = 2640^{\#} (\text{UP})$$

$$T.E. \text{ MOM}_F.S. = -70,800^{\prime\prime} (\text{C-CLOCKWISE})$$

REF PG. 227

THE L.E. SHEAR IS APPLIED TO THE  
F.S. THE L.E. MOMENT IS APPLIED AS  
A COUPLE TO THE F.S. FLANGES.

$$\text{COUPLE} = \frac{23,600}{35.935} = 662^{\#} \curvearrowright$$

THE T.E. SHEAR IS APPLIED EQUALLY  
TO THE ENGINE MT. FITTINGS.

$$\frac{2640}{2} = 1320^{\#} (\text{UP})$$

THE T.E. MOMENT IS APPLIED AS A  
COUPLE TO THE ENGINE MT. FITTINGS.

$$\text{COUPLE} = \frac{70,800 - 2640(57.25)}{49.5} = 1120^{\#} \curvearrowleft$$

ANALYSIS WING  
PREPARED BY Russell  
CHECKED BY Beefield  
REVISED BY \_\_\_\_\_

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FORT WORTH, TEXAS

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## WING BULKHEAD #23

### ENGINE MT. FITTING LOADS

M.F.W. - L.A.A. UNSYMGUST @ 6'000', REF. P. 222

#### UPPER FITTING

$$D = 53,911^* \text{ (AFT)}$$

$$V = 17,468^* \text{ (DOWN)}$$

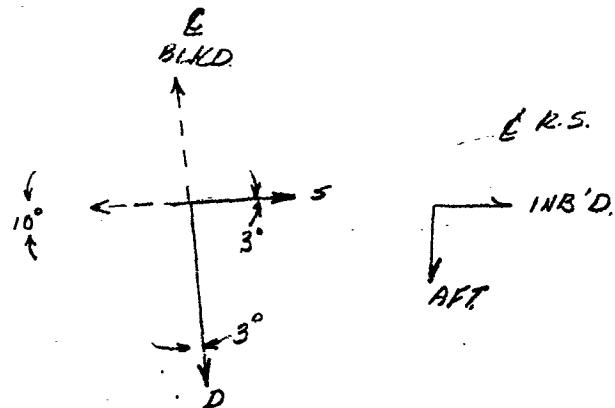
$$S = 7,233^* \text{ (INB'D.)}$$

#### LOWER FITTING

$$D = 60,344^* \text{ (FWD.)}$$

$$V = 15,449^* \text{ (DOWN)}$$

$$S = 6,762^* \text{ (OUTB'D.)}$$



ENGINE MT. LOADS ARE RESOLVED INTO  
PLANE OF BLKD AND R.S.

#### UPPER

$$D' = D \cos 3^\circ - S \sin 3^\circ = 53,911 \times .9986 - 7233 \times .0523 = 53,458^*$$

$$S' = D \sin 3^\circ + S \cos 3^\circ = 53,911 \times .0523 + 7233 \times .9986 = 10,043^*$$

$$D'' = S' \tan 10^\circ = 10,043 \times .1763 = 1771^*$$

$$D_{\text{TOTAL}} = 53,458 + 1771 = \underline{\underline{55,229^*}}$$

#### LOWER

$$D' = -60,344 \times .9986 + 6762 \times .0523 = -59,906^*$$

$$S' = -60,344 \times .0523 - 6762 \times .9986 = -9909^*$$

$$D'' = -9909 \times .1763 = -1747^*$$

$$D_{\text{TOTAL}} = -59,906 - 1747 = \underline{\underline{-61,653^*}}$$

ANALYSIS WING  
PREPARED BY RUSSELL  
CHEKED BY Carfield  
REVISED BY

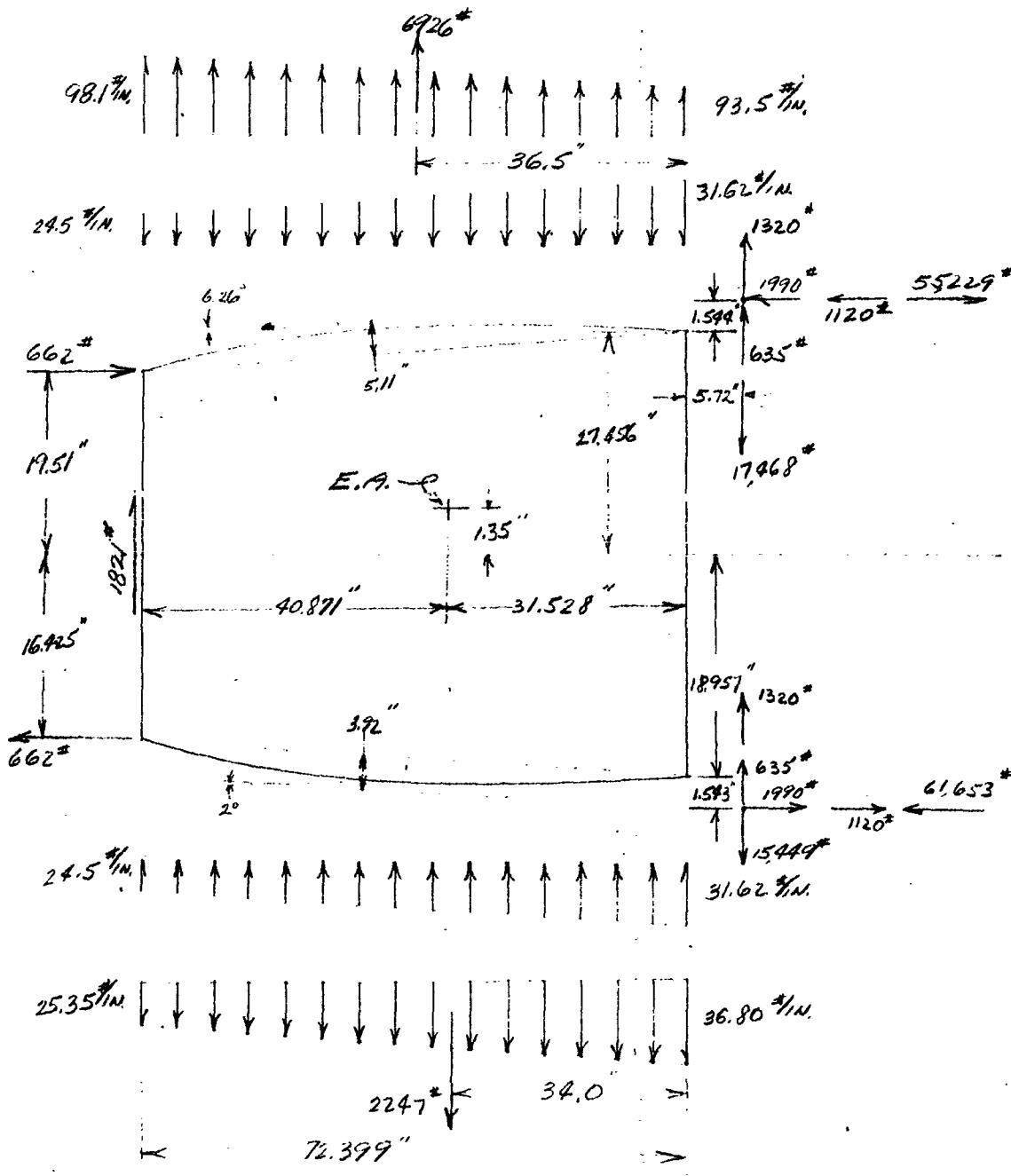
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WING BULKHEAD 23

### APPLIED LOADS

M.F.W. - L.A.A. unsym Gust @ 5000'



ANALYSIS WING  
PREPARED BY Russell  
CHECKED BY Campfield  
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## WING BULKHEAD #23

$\Sigma$  LOADS ABOUT ELASTIC AXIS

DRAG

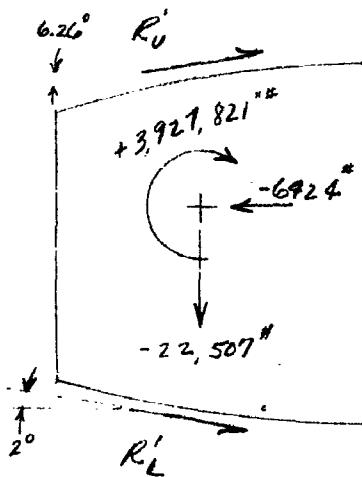
$$D = 55,229 - 61,653 = -6,424^* \text{ (FM/D)}$$

VERT.

$$V = 6926 - 2247 - 17,968 - 15,447 + 2(635) + 2(1320) + 1821 \\ = -22,507^* \text{ (DOWN)}$$

$\Sigma$  MEA (+CLOCKWISE)

$$\text{MOM.} = +662(35.935) + 1821(40.871) + 6926(4.472) \\ - 2247(2.472) - 1990(49.50) - 1120(49.50) + 55,229(27.65) \\ + 61,653(21.85) - 1320(2) \times 37.253 - 2(635) \times 37.253 \\ - 17,610(37.253) + 15,949 \times 37.253 \\ \Rightarrow 3,927,821^*$$



ANALYSIS WING  
PREPARED BY Russell  
CHECKED BY Canfield  
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## WING BULKHEAD #23

2 LOADS ABOUT EA. (CONT'D)

THE DRAG IS REACTED AT THE UPPER AND LOWER SURFACE SHEAR CENTERS.

$$R_U = 6924 \left( \frac{23.25}{50.90} \right) = +2934^* \text{ (AFT)}$$

$$R_L = 6924 \left( \frac{27.65}{50.90} \right) = +3490^* \text{ (AFT)}$$

RESOLVE  $R_U + R_L$  PARALLEL TO THE SHEAR CENTER.

$$R_U' = \frac{2934}{\cos 6.26^\circ} = \frac{2934}{.992} = 2958^*$$

$$R_L' = \frac{3490}{\cos 2^\circ} = \frac{3490}{.999} = 3493^*$$

REACTING  $R_U'$  &  $R_L'$  AS SHEAR FLOWS.

$$f_U = \frac{2958}{72.4} = 41.8^{\frac{3}{4}} \text{ in.}, f_L = \frac{3493}{72.4} = 48.3^{\frac{3}{4}} \text{ in.}$$

RESOLVE  $R_U + R_L$  L TO CHORD LINE.

$$R_{U\perp} = 2934 \tan 6.26^\circ = 322^* \text{ (UP)}$$

$$R_{L\perp} = 3493 \tan 2^\circ = \frac{122^*}{200^*} \text{ (DOWN)}$$

REACT. AT FRONT AND REAR SPAR.

$$F.S. = 200 \left( \frac{31.528}{72.399} \right) = -87^* \text{ (DOWN)}$$

$$R.S. = 200 - 87 = 113^* \text{ (DOWN)}$$

ANALYSIS *W.H.W.*  
PREPARED BY *Russell*  
CHECKED BY *Campfield*  
REVISED BY

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## WING BULKHEAD #23

### $\Sigma$ LOADS ABOUT E.A. (CONT'D)

REACT. VERT. UNBALANCE AT F.S. & R.S.

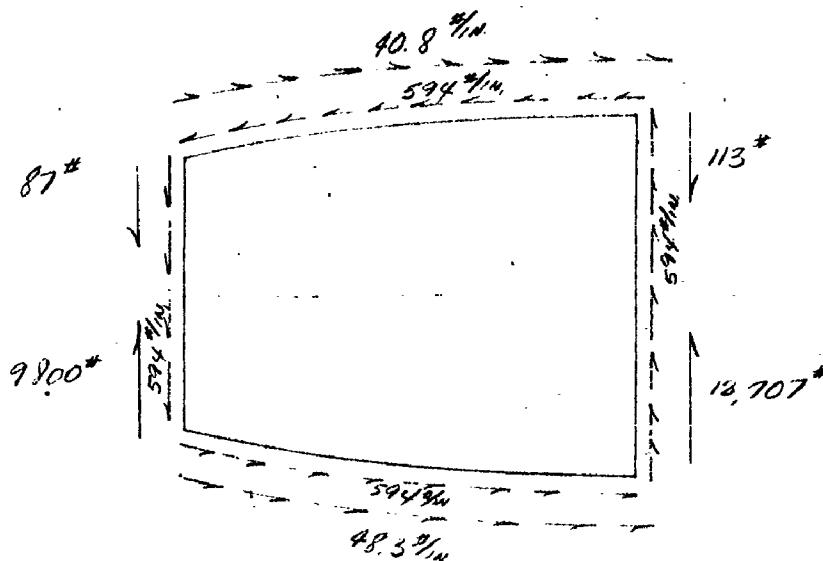
$$R_{F.S.} = 22,507 \left( \frac{31.578}{72.399} \right) = +9,800^* \text{ (UP)}$$

$$R_{R.S.} = 22,507 \left( \frac{40.871}{72.399} \right) = +12,707^*$$

REACT. TORQUE AS SHEAR AROUND BLD.

$$g_T = \frac{T}{2A} = \frac{3,927.821}{6616} = -594^{\frac{1}{2}}\text{in}$$

### REACTIONS TO BULKHEAD



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PREPARED BY RUSSELL  
CHECKED BY Campfield  
REVISED BY \_\_\_\_\_

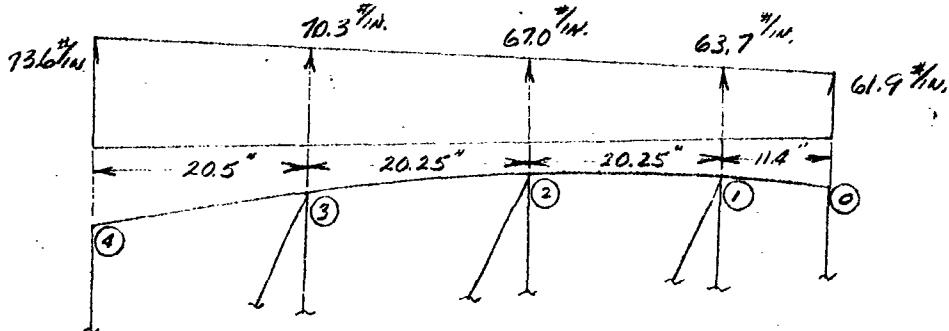
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## WING BULKHEAD #23

### PANEL POINT LOADS (UPPER SURF)

CALCULATION OF PANEL POINT LOADS  
DUE TO CRUSHING & AIRLOADS. (REF. FOR  
APPLIED LOADS PG. 232)



$$\frac{73.6 - 61.9}{72.4} = \frac{w}{X} ; w = \frac{11.7 X}{72.4}$$

$$w_1 = \frac{11.7(11.4)}{72.4} = 1.84 , w_2 = \frac{11.7(31.65)}{72.4} = 5.11$$

$$w_3 = \frac{11.7(51.90)}{72.4} = 8.38$$

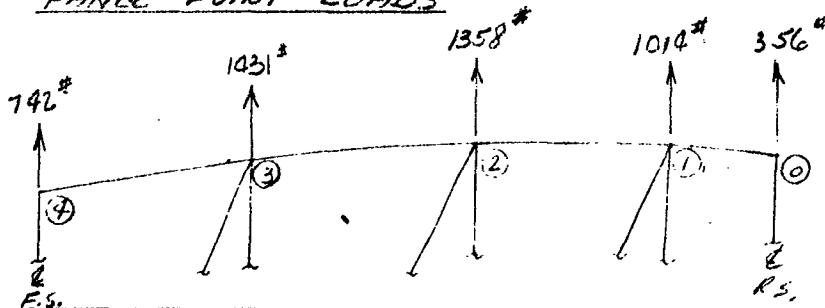
### ORDINATES

$$AT, 1 = 61.9 + 1.84 = 63.7$$

$$2 = 61.9 + 5.11 = 67.0$$

$$3 = 61.9 + 8.38 = 70.3$$

### PANEL POINT LOADS



ANALYSIS WINGS  
PREPARED BY Russell  
CHECKED BY Campfield  
REVISED BY

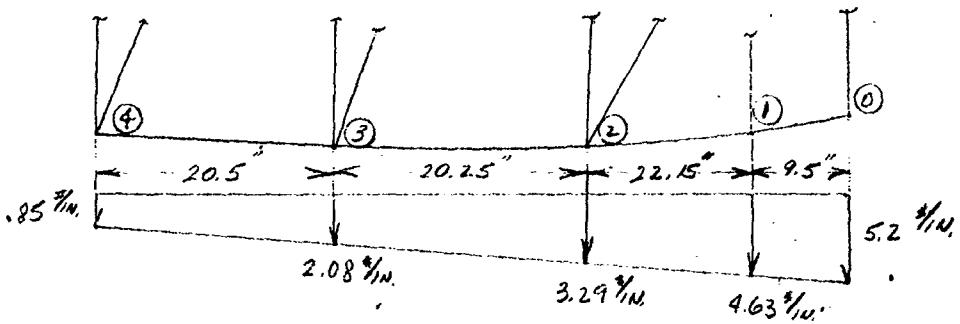
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DATE 11/5/47

## WING BULKHEAD #23

### PANEL POINT LOADS (LOWER SURF.)

CALCULATION OF PANEL POINT LOADS  
DUE TO CRUSHING + AIRLOADS. (REF FOR  
APPLIED LOADS PG 232)



$$\frac{52 - .85}{72.4} = \frac{w}{x} ; w = \frac{4.35}{72.4}$$

$$w_1 = \frac{62.9 \times 4.35}{72.4} = 9.78 \text{ lb/in.}, w_2 = \frac{40.75 \times 4.35}{72.4} = 1.77 \text{ lb/in.}$$

$$w_3 = \frac{20.5 \times 4.35}{72.4} = 1.23 \text{ lb/in.}$$

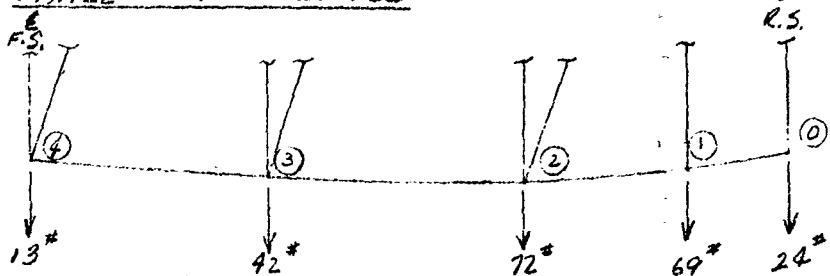
### ORDINATES

$$\text{AT } 1 = .85 + 3.78 = 4.63 \text{ lb/in.}$$

$$2 = .85 + 2.44 = 3.29 \text{ lb/in.}$$

$$3 = .85 + 1.23 = 2.08 \text{ lb/in.}$$

### PANEL POINT LOADS



ANALYSIS WING  
PREPARED BY Russell  
CHECKED BY Craigfield  
REVISED BY \_\_\_\_\_

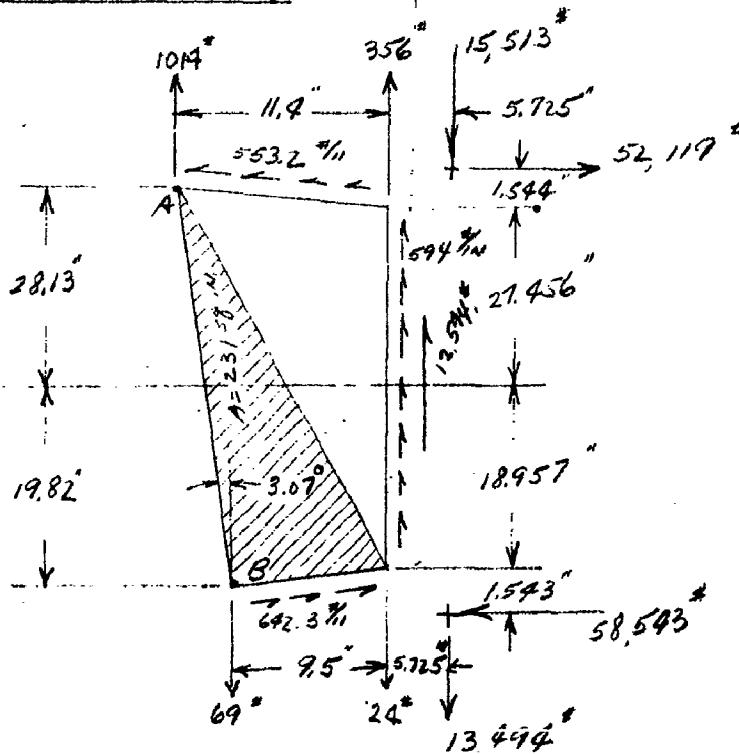
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DATE 11/13/47

## WING BULKHEAD #23

### WEB REACTIONS TO TRUSS

FOR LOADS SEE  
PGS. 232, 236 & 237



$$\sum M_A = 0$$

$$\begin{aligned} 47.95 R_B &= -(356 + 46.413(594) + 12,594 - 24) 11.4 \\ &\quad + (15,513 + 13,494) 17.125 + 58,593(48.63) \\ &\quad + 52,119(.87) + 69(1.9) - 642.3 \times 2(231) \\ &= +2,622,670'' \text{ (clockwise)} \end{aligned}$$

$$R_{B_H} = \frac{2,622,670}{47.95} = +55,000'' \text{ (AFT)}$$

ANALYSIS WING  
PREPARED BY KUSSELL  
CHECKED BY Campfield  
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WING BULKHEAD #23

WEB REACTIONS TO TRUSS (CONT'D)

$$\Sigma_H = 52,119 - 553.2(11.4) - 58,543 + 642.3(9.5) \\ = -6634^* \text{ (FWD)}$$

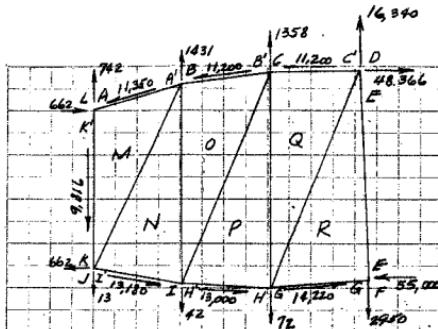
$$R_{AH} = R_{BH} - 6634^* \\ = 55,000 - 6634 = 48,376 \text{ (FWD)}$$

$$R_{BY} = 55,000 \times \tan 3.07^\circ = 2950^* \text{ (UP)}$$

$$\Sigma_V = 356 - 15,513 + 594(46.413) + 12,594 - 24 + 1014 \\ - 13,994 - 69 + 553.2(.674) + 642.3(.863) \\ = +13,390^*$$

$$R_{AY} + R_{AV} = -13,390$$

$$R_{AY} = -13,390 - 2950 \\ = -16,340^*$$



КЕПЧЕГ ШЕСЕН СО<sup>т</sup> И А  
Page 240

$$\begin{array}{ll}
 AM = -280 & KM = +9600 \\
 AM = +11000 & KM = +600 \\
 BO = +14,900 & MN = +10,000 \\
 BO = +26,100 & NO = -8,800 \\
 CQ = +39,100 & OP = +11,200 \\
 CQ = +41,300 & PQ = -11,600 \\
 & QR = +18,100
 \end{array}$$

$GR =$	-	55,100
$GR =$	-	40,800
$HP =$	-	33,800
$HP =$	-	20,800
$IN =$	-	16,800
$IN =$	-	3,600

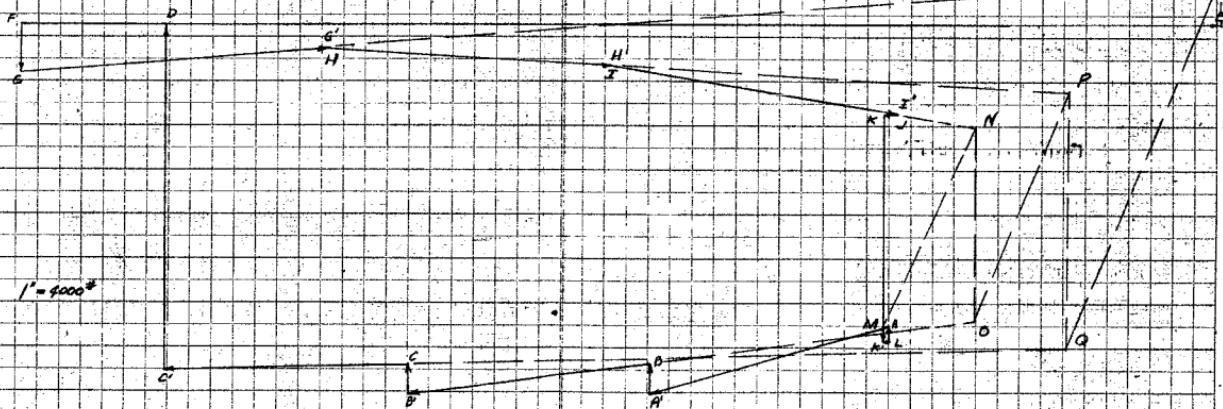


FIGURE 23

**CALCULATED BY**  
**DRAWN BY**  
**CHECKED BY**  
**APPROVED BY**

**TRUSS MEMBER LOADS**  
MFN - L.R.A. LIVINGSTON @ 5000 FT.  
**CONSOLIDATED VULTEE AIRCRAFT CORPORATION**  
FORT WORTH DIVISION, FORT WRIGHT, TEXAS

DOC. NO.  
EX-36-36  
MODEL  
16-36

ANALYSIS WING  
PREPARED BY LOWREY  
CHECKED BY Mefford  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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DATE

WING BULKHEAD #23

CONDITION

MIN FLYING WT. (136,015<sup>0</sup>) T.L.A.P. UNSTAB. GEAR  
@ 5000'

ANALYSIS WING  
PREPARED BY RUSSELL  
CHECKED BY Mofford  
REVISED BY \_\_\_\_\_

Consolidated Vallee Aircraft Corporation  
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DATE 11/29/47

WING BULKHEAD #23

CRUSHING LOADS (M.F.W - I.L.A.A. UNSYM GUST @ 5000)

$M_x$  IS ASSUMED EQUAL TO  $M_x$

$M_x = 16,200,000$  " (OBTAINED FROM PRELIMINARY CALCULATIONS)

$$P_{cr} = \frac{(M_x)^2 L}{(Q)_x EI}$$

$$\left. \begin{aligned} I_x &= 22,660 \text{ in.}^4 \\ Q_x &= 515.24 \text{ in.}^3 \\ L &= 37.0 \text{ (BLKD. SPACING)} \\ E &= 10,300,000 \end{aligned} \right\}$$

F25-36-142  
PG. II-201

$$P_{cr} = \frac{(16,200,000)^2 (37)}{\left(\frac{22660}{515.24}\right) 10.3 \times 10^6 \times 22660} = 993 \text{ #}$$

CRUSHING LOAD WILL BE DISTRIBUTED TRAPEZOIDALLY IN PROPORTION TO SPAR DEPTHS.

$$F.S. = 35.935$$

$$R.S. = 46.413$$

$$2 \overline{) 82,348}$$

41.174 AVERAGE SPAR DEPTH

$$\frac{993}{72.4} = 13.03 \text{ #/in. AVERAGE LOADING OVER CHORD}$$

$$\text{AT F.S.}, w = \frac{35.95}{41.174} \times 13.03 = \underline{11.38 \text{ #/in.}}$$

$$\text{AT R.S.}, w = \frac{46.413}{41.174} \times 13.03 = \underline{19.70 \text{ #/in.}}$$

**CONSOLIDATED VULTEE AIRCRAFT CORPORATION**  
FORT WORTH DIVISION  
FW 853 7-46 ENGINEERING RULED TABULATION PAD-VELLUM

TABLE  
X-218

WING BULKHEAD #<sup>23</sup>  
SHEAR AND BEND MOM. OF AIRLOAD ABOUT F.S. (I.E. AIRLOAD)  
MENW-19A.1 @ 5000'

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xs-36

% CHORD (%)	DIST. FROM FS	DIST. BETW. STA.	P <sub>BM</sub>	P <sub>AVG</sub> )	0.5 b = 37	5 (KNOTS)	DIST TO CENTROID	CM	AM	MT (KNOTS)	5 (KNOTS)	M (WT)		
(1)	(2)	(3)	(4)	(5)	(6) <del>37.5</del> 37.5	(7) <del>3</del> 26	(8)	(9) <del>1</del> 17	(10) <del>1</del> 13	(11) <del>2</del> 17	(12) <del>1</del> 15	(5) <del>1</del> 15		
0	28.12	0				0		0	0	0				
.02	23.45	4.67	351	421		2.31		971	0	971				
.04	18.78	4.67	366	439		2.36		1038	1962	3971				
.06	14.11	4.67	332.5	399		2.39		753	9010	8934				
.08	9.34	4.67	310	398	1254			852	5880	15696				
.10	4.67	4.67	290	306	1607			728	7500	23872				
.12	0	4.67	255	273	1913									
			215		2186			650	8930	33454	3280	50200		

PREPARED BY: RUSSELL 11/14/47  
CHECKED BY: McGifford

**TABLE I** SHEAR AND BENDING MOMENT OF AIRLOAD ABOUT R.S. (T.E. AIRLOAD)  
M.F.W.-I.L.A.A @ 5000'

143-56

% CHORD (%)	DIST. FROM P.S.	DIST. BETW. STA.	P(STA.)	P(OVE)	DS (=37)	S (CONST.)	DIST TO CENTROID	DM <sub>1</sub>	DM <sub>2</sub>	M <sub>T</sub> (CONST.)	S (ULT.)	M (ULT.)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
					37/35/33	3/6		(8)x(6)	(3)x(7)	(2) + (10)	15 x (7)	15 x (4)
.679	58.16		-25			0		0	0	0		
	677		-25	-44			3.39					
.650	51.39		-25	i		-44		-149	0	-149		
	584		-25	-38			2.92					
.625	45.55		-25			-82		-111	-257	-517		
	584		-25	-38			2.92					
.600	39.71		-25			-120		-111	-479	-1107		
	584		-23.5	-35			2.86					
.575	33.87		-22			-155		-100	-702	-1909		
	584		-20	-30			2.83					
.550	28.03		-18			-185		-85	-907	-2901		
	584		-15.5	-23			2.76					
.525	22.19		-13			-208		-64	-1080	-4095		
	584		-10	-15			2.63					
.500	16.35		-7			-223		-39	-1215	-5299		
	584		-3.5	-5			1.93					
.475	10.51		0			-228		-10	-1309	-6613		
	584		+4	+6			3.86					
.450	4.67		+8			-222		+23	-1332	-7922		
	584		+12	+18			2.59					
.430	0		+16			-208		+97	-1038	-8913	-306	-13380

#### TRANSFER SHEAR TO AFT FITTINGS

$$\text{REDUCED MOM.} = 13,380 - 306(5.725) = 11,630''$$

PREPARED BY: ROSELL H/19/97  
CHECKED BY: M. J. Hoffman H/25/97

TABLE  
II

WING BULKHEAD #23  
INTERSPAR AIRLOAD  
M.E.W. - I.L.A.A. @ 5000'

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P-25-36-240  
18-36

	% CHORD (%)	DIST. BETW. STG.	$P_{(PSI)}$	$P_{(PSI)}$	DS 6.37	S (MM)	DIST. TO CENTROID	DM	DM <sub>2</sub>	M <sub>T</sub> (MM)	S (MM)	M (MM)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)		
					$371.2 \times 3$	$\Sigma 5$	$\Sigma 5 \times 5$	$\Sigma 5$	$\Sigma 5 \times 5$	$\Sigma 5 \times 5 + 5$	$\Sigma 5$	$\Sigma 5 \times 5$		
UPPER SURFACE	.12	22			0		0	0	0	0	0	0		
	.15	700	375	67		3.02								
	.15	53			67		200	0	200					
	.20	1168	70	210		5.37								
	.20	87			277		1130	780	2110					
	.25	1168	98.5	296		5.60								
	.25	110			573		1660	3240	2010					
	.30	1168	117.5	353		5.71								
	.30	125	122.5	382		5.79								
	.35	130			1308		2210	10,750	28,800					
LOWER SURFACE	.35	1868	126.5	607		726								
	.43	123			1915		5620	24,450	58,870	2875	88310			
	.12	137			0		0	0	0	0	0	0		
	.15	700	235	423		3.51								
	.15	233			423		1490	0	1990					
	.20	1168	228.5	685		5.89								
	.20	224			1108		4030	4760	10,880					
	.25	1168	218.5	655		5.90								
	.25	213			1763		3870	12,930	27,280					
	.30	1168	205.5	616		5.93								
	.30	198			2379		3660	20,620	51,590					
UPPER SURFACE	.30	1168	189	567		5.94								
	.35	180			2916		3370	27,800	86,710					
	.35	1868	163	782		7.65								
	.43	146			3728		7550	34,000	115,160	5540	212090			

PREPARED BY: RUSSELL 11/24/07  
CHECKED BY: J. S. 1/21/08

ANALYSIS WING  
PREPARED BY RUSSELL  
CHECKED BY M. J. FORD  
REVISED BY

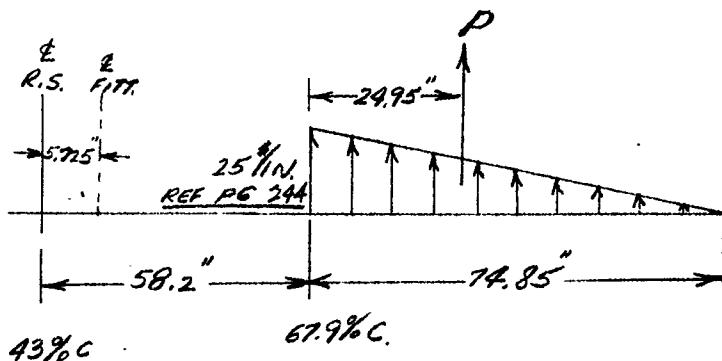
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## WING BULKHEAD #23

### NACELLE AIR LOAD

SEE DISCUSSION ON PG II-97, F25-36-142



$$P_{(ULT)} = 1.5 \left( \frac{25}{2} \times \frac{74.85}{2} \times \frac{37}{12} \right) = 361^{\#}$$

THIS LOAD IS INTRODUCED AS A COUPLE AT THE ENGINE MT FITTINGS AND AN EQUAL SHEAR ON EACH FITTING.

$$\text{COUPLE} = \frac{361 \times 77.925}{49.5} = 565^{\#} \leftarrow$$

$$\text{SHEAR} = \frac{361}{2} = 180.5^{\#}/\text{FITTING (UP)}$$

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CHECKED BY Deppendorf  
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## WING BULKHEAD #23

### L.E. & T.E. AIRLOADS

$$L.E. \text{ SHEAR} = -3280^* \text{ (DOWN)}$$

$$L.E. \text{ MOM. F.S.} = -50,200^* \text{ (C-CLOCKWISE)} \quad \text{REF. PG. 243}$$

$$T.E. \text{ SHEAR} = 306^* \text{ (UP)}$$

$$T.E. \text{ MOM. R.S.} = 11,630^* \text{ (C-CLOCKWISE)}$$

THE L.E. SHEAR IS APPLIED AT THE F.S.. THE L.E. MOMENT IS APPLIED AS A COUPLE TO THE F.S. FLANGES,

$$\text{COUPLE} = \frac{50,200}{35.935} = 1396^* \leftarrow \rightarrow$$

THE T.E. SHEAR IS APPLIED EQUALLY TO THE ENGINE MT. FITTINGS

$$\frac{306}{2} = 153^* \text{FITTING (UP)}$$

THE T.E. MOMENT IS APPLIED AS A COUPLE TO THE ENGINE MT. FITTINGS

$$\text{COUPLE} = \frac{11630}{49.5} = 235^* \leftarrow \rightarrow$$

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PREPARED BY RUSSELL  
CHECKED BY Mayfield  
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DATE 11/29/47

## WING BULKHEAD #23

### ENGINE MT FITTING LOADS

M.F.W - ILLA - UNSYM GUST @ 6000' REF. P. 222

#### UPPER FITTING

$$V = +11,279^*$$

$$D = -35,861^*$$

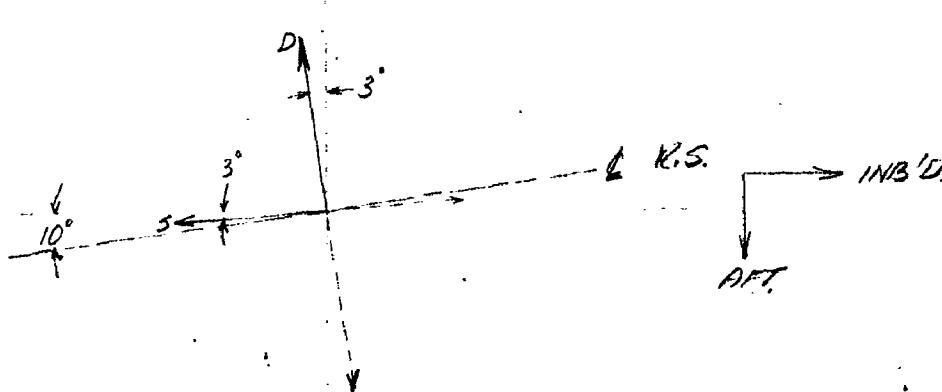
$$S = -4,617^*$$

#### LOWER FITTING

$$V = +10,097^*$$

$$D = +34,528^*$$

$$S = +3940^*$$



ENGINE MT LOADS ARE RESOLVED INTO  
PLANE OF BULK'D AND R.S.

#### UPPER

$$D' = D \cos 3^\circ + S \sin 3^\circ = -35,861(0.9986) + 4617(0.0523) = -35,570$$

$$S' = D \sin 3^\circ - S \cos 3^\circ = -35,861(0.0523) - 4617(0.9986) = -6490^*$$

$$D'' = S \tan 10^\circ = -6490(0.1763) = -1140^*$$

$$D_{TOTAL} = -35,570 + (-1140) = -\underline{36,710}^*$$

#### LOWER

$$D' = D \cos 3^\circ - S \sin 3^\circ = 34,528(0.9986) - 3940(0.0523) = +34,270^*$$

$$S' = D \sin 3^\circ + S \cos 3^\circ = 34,528(0.0523) + 3940(0.9986) = +5790^*$$

$$D'' = S \tan 10^\circ = +5790(0.1763) = +1010^*$$

$$D_{TOTAL} = 34,270 + 1010 = +\underline{35,280}^*$$

ANALYSIS WING  
PREPARED BY RUSSELL  
CHECKED BY McGifford  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation

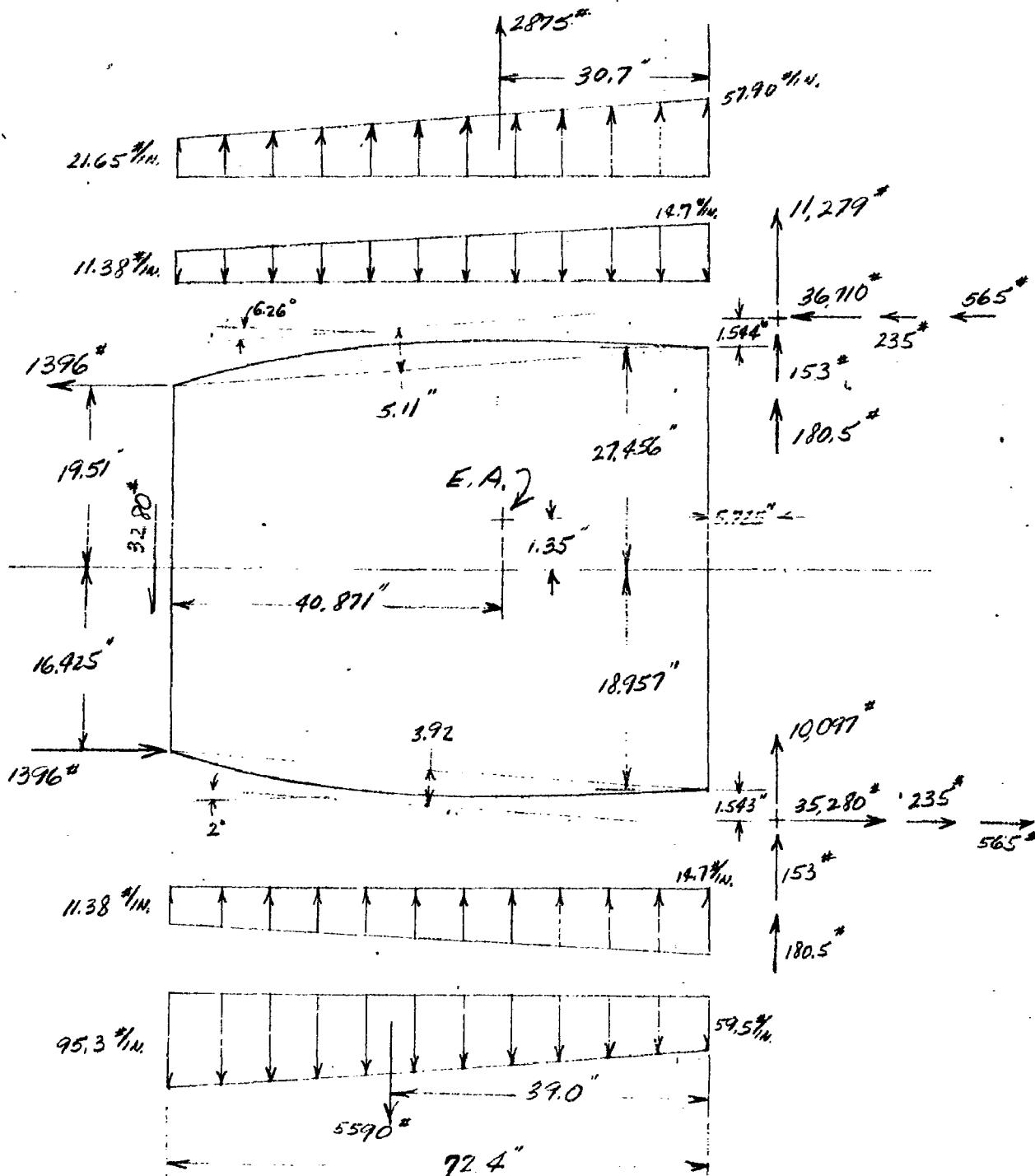
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WING BULKHEAD #23

APPLIED LOADS

M.F.W - I.L.A.A - UWSVM Gust @ 5000'



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## WING BULKHEAD #23

### $\Sigma$ LOADS ABOUT ELASTIC AXIS

#### DRAG

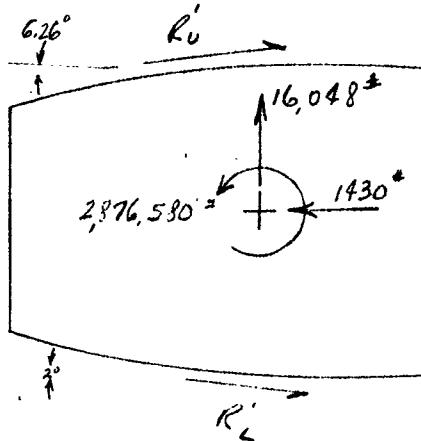
$$D = -36,710 + 35,280 = -1930 \text{ (FWD.)}$$

#### VERT.

$$\begin{aligned} V &= +2875 + 11279 + 333.5 + 10,097 + 333.5 \\ &\quad - 5590 - 3280 \\ &= +16,048^* \text{ (UP)} \end{aligned}$$

#### $\Sigma M_{ea}$ (+ COUNTERWISE)

$$\begin{aligned} MOM. &= -1396(35.935) - 3280(40.871) - 2875(828) \\ &\quad - 11,613(37.253) - 37,510(27.65) - 36,080(21.85) \\ &\quad - 10,431(37.253) - 5590(1.472) \\ &= -2,876,580^* \end{aligned}$$



ANALYSIS WING  
PREPARED BY RUSSELL  
CHECKED BY \_\_\_\_  
REVISED BY \_\_\_\_

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## WING BULKHEAD #23

### E LOADS ABOUT E.A (CONT'D)

THE DRAG IS REACTED AT THE UPPER AND LOWER SURFACE SHEAR CENTERS.

$$R_U = 1430 \left( \frac{23.25}{50.90} \right) = 653^*$$

$$R_L = 1430 \left( \frac{27.65}{50.90} \right) = 777^*$$

RESOLVE  $R_U$  &  $R_L$  PARALLEL TO SHEAR CENTERS.

$$R_U' = \frac{653}{\cos 6.26^\circ} = 658^*$$

$$R_L' = \frac{777}{\cos 2^\circ} = 778^*$$

REACT  $R_U'$  &  $R_L'$  AS SHEAR FLOWS.

$$\delta_U = \frac{658}{72.4} = 9.1 \text{ IN} , \quad \delta_L = \frac{778}{72.4} = 10.75 \text{ IN}$$

RESOLVE  $R_U$  &  $R_L$  ⊥ TO CHORD LINE.

$$R_{UU} = 653 \tan 6.26^\circ = 70.5^* (\text{UP})$$

$$R_{UL} = 777 \tan 2^\circ = \underline{27.1^* (\text{DOWN})}$$

TOTAL = 43.4 (UP)

REACT. AT FRONT AND REAR SHEAR

$$F.S. = 43.4 \left( \frac{31.528}{72.399} \right) = 18.9^* (\text{DOWN})$$

$$R.S. = 43.4 - 18.9 = 24.5^* (\text{DOWN})$$

ANALYSIS WING  
PREPARED BY RUSSELL  
CHECKED BY Hofford  
REVISED BY \_\_\_\_\_

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## WING BULKHEAD #23

### E LOADS ABOUT EA. (CONT'D)

REACT VERT. UNBALANCE AT F.S. & R.S.

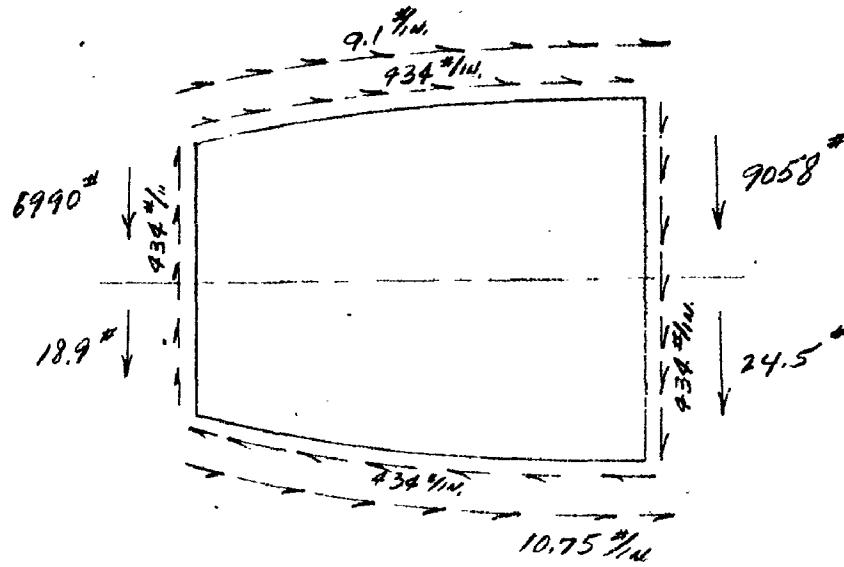
$$R_{F.S.} = 16048 \left( \frac{31.528}{72.4} \right) = 6990^{\circ} (\text{down})$$

$$R_{R.S.} = 16048 \left( \frac{40.871}{72.4} \right) = 9058^{\circ} (\text{down})$$

REACT TORQUE AS SHEAR AROUND BLKD.

$$g_T = \frac{T}{2A} = \frac{2376580}{6616} = 434^{\circ}/\text{in.}$$

### REACTIONS TO BULKHEAD



ANALYSIS WING  
PREPARED BY KUSSELL  
CHECKED BY *[Signature]*  
REVISED BY

Consolidated Vultee Aircraft Corporation

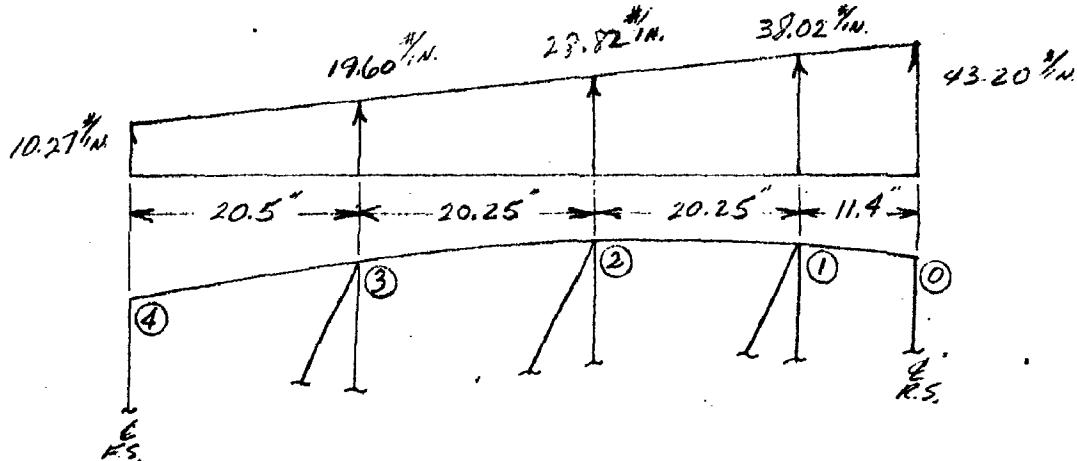
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## WING BULKHEAD #23

### PANEL POINT LOADS (UPPER SURF.)

CALCULATION OF PANEL POINT LOADS  
DUE TO CRUSHING + AIR LOADS. (REF PG. 249  
FOR APPLIED LOADS).



### ORDINATES AT PANEL POINTS

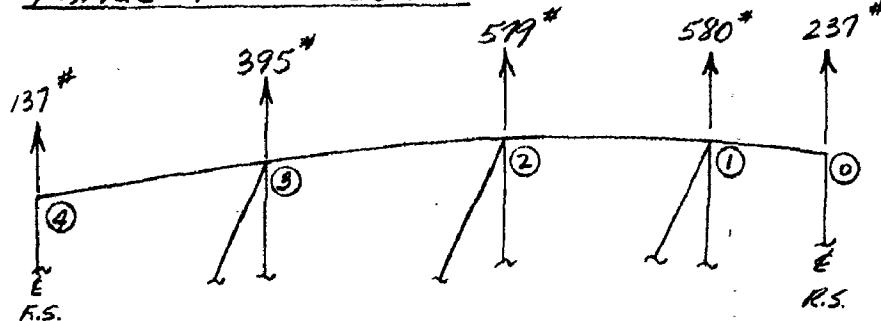
$$\frac{32.93}{72.4} = \frac{x}{L}, \quad \frac{32.93 L}{72.4} = x, \quad x = .455 L$$

AT ①  $w = 10.27 + 61.0(.455) = 38.02 \frac{1}{4}$  in.

②  $w = 10.27 + 40.75(.455) = 28.82 \frac{1}{4}$  in.

③  $w = 10.27 + 20.5(.455) = 19.60 \frac{1}{4}$  in.

### PANEL POINT LOADS



ANALYSIS WING  
PREPARED BY RUSSELL  
CHECKED BY M.J.P.  
REVISED BY

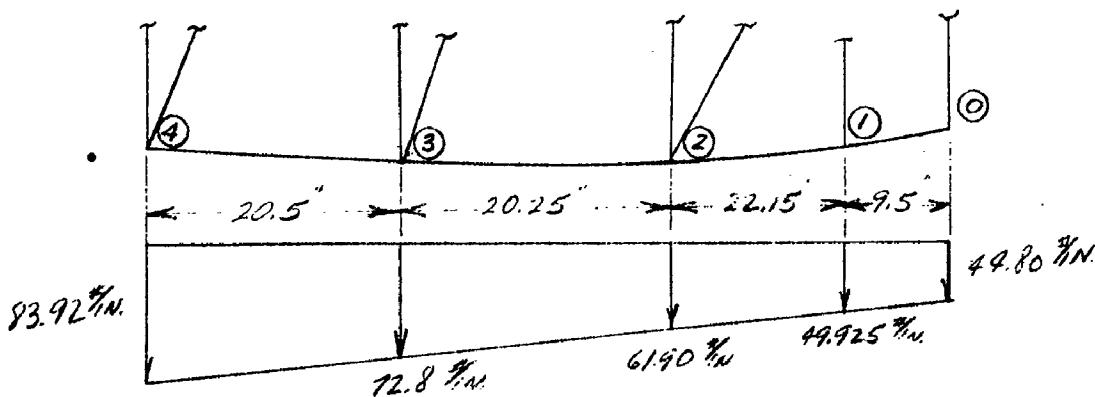
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DATE 11/24/47

## WING BULKHEAD #23

### PANEL POINT LOADS (LOWER SURF)

CALCULATION OF PANEL POINT LOADS  
DUE TO CRUSHING AND AIR LOADS.  
(REF. PG 249 FOR APPLIED LOADS)

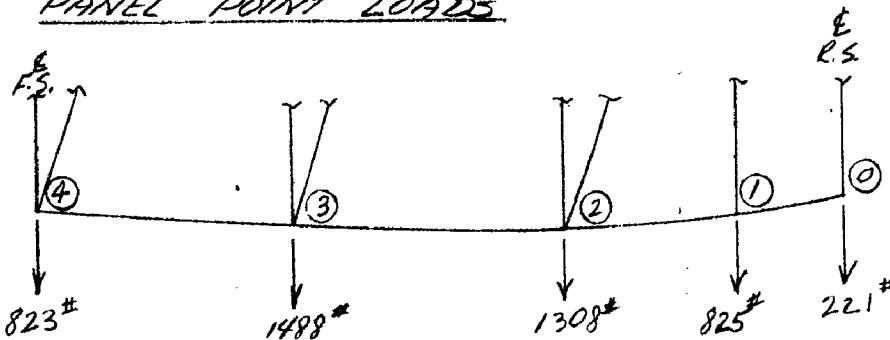


### ORDINATES AT PANEL POINTS

$$\frac{32.12}{72.4} = \frac{x}{L}, \quad \frac{39.12}{72.4} L = x, \quad x = .54(L)$$

- At. ①  $w = 44.8 + 9.5(.54) = 49.925 \text{ %N}$   
②  $w = 44.8 + 31.65(.54) = 61.90 \text{ %N}$   
③  $w = 44.8 + 51.90(.54) = 72.8 \text{ %N}$

### PANEL POINT LOADS



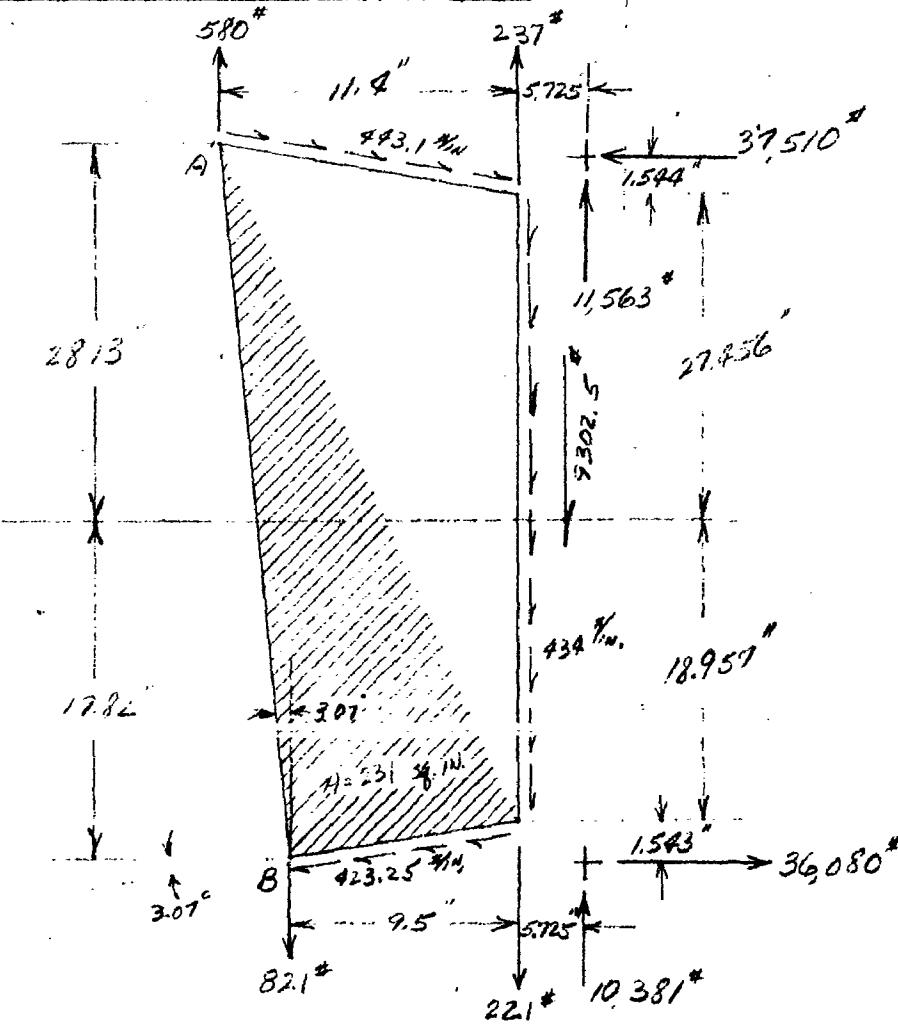
ANALYSIS WING  
PREPARED BY RUSSELL  
CHECKED BY John  
REVISED BY

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FORT WORTH DIVISION  
FORT WORTH, TEXAS

PAGE 255  
REPORT NO. F25-36-246  
MODEL XB-36  
DATE 11/25/47

## WING BULKHEAD #23

### WEB REACTIONS TO TRUSS



$$\Sigma M_A = 0$$

$$47.95 R_B = -11.4(237) + 11.4(434 \times 46.413) + 11.4(9032.5) \\ + 11.4(221) - 17.125(11.563) - 17.125(10.381) \\ - .87(37.510) - 98.63(36,080) + 2(231)(423.25) \\ + 1.9(821) \\ = -1637,000 "$$

$$K_{B_H} = \frac{1637,000}{47.95} = -34,100^* (\text{FWD})$$

ANALYSIS WING  
PREPARED BY Russell  
CHECKED BY enfield  
REVISED BY

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FORT WORTH DIVISION  
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DATE 11/25/47

WING BULKHEAD #23

WEB REACTIONS TO TRUSS (CONT'D.)

$$\Sigma H = 0$$

$$= +443.1(11.4) - 37,510 + 36,080 - 423.25(9.5) \\ - 34,100 + R_{AH} = 0$$

$$R_{AH} = 34,510^{\circ} (\text{AFT})$$

$$R_{BV} = R_{BH} \tan 3.07^{\circ} = -34,000(.0396) = -\underline{1850^{\circ}} (\text{DOWN})$$

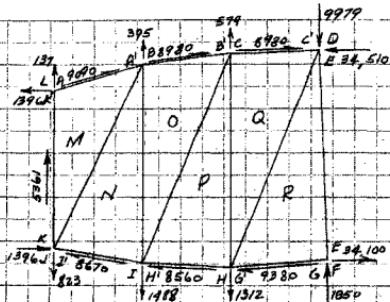
$$\Sigma V = 0$$

$$= -443.1(.674) + 237 + 11,563 - 434(96.413) - 9032.5 \\ + 10,381 - 221 - 821 + 580 - 423.25(.863) - 1850 + R_{VA} = 0$$

$$R_{VA} = \underline{9974^{\circ}}$$

KENNER VEEBES CO. A

سید علی بن ابی طالب



<i>AM</i>	<i>= + 13,600</i>	<i>H/P</i>	<i>= + 12,300</i>
<i>AM</i>	<i>= - 8,090</i>	<i>IN</i>	<i>= + 9,800</i>
<i>BO</i>	<i>= - 10,280</i>	<i>TN</i>	<i>= + 11,000</i>
<i>BO</i>	<i>= - 12,200</i>	<i>KM</i>	<i>= + 6,000</i>
<i>CQ</i>	<i>= - 21,700</i>	<i>K'M</i>	<i>= + 500</i>
<i>CQ</i>	<i>= - 39,550</i>	<i>MN</i>	<i>= - 5,600</i>
		<i>NO</i>	<i>= + 6,400</i>
<i>GR</i>	<i>= + 34,150</i>	<i>OP</i>	<i>= - 6,300</i>
<i>GR</i>	<i>= + 24,150</i>	<i>PB</i>	<i>= + 7,730</i>
<i>HP</i>	<i>= + 20,800</i>	<i>QR</i>	<i>= - 10,800</i>

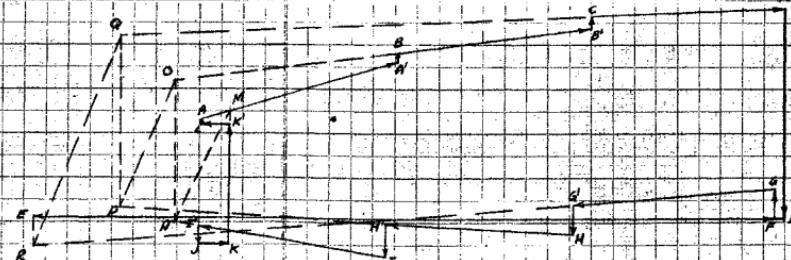


FIGURE C-4  
TRUSS MEMBER LOADS  
F.W.-I.L.A.A-LC-1000000000000000

CALCULATED BY	
DRAWN BY	RECEIVED Edgar
CHECKED BY	
APPROVED BY	

**CONSOLIDATED VULTEE AIRCRAFT CORPORATION**  
**FORT WORTH DIVISION, FORT WORTH, TEXAS**

DOC. NO.

**MODEL**

XB-36

ANALYSIS WING  
PREPARED BY LONGLEY  
CHECKED BY Mefford  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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MODEL XB-36  
DATE \_\_\_\_\_

WING BULKHEAD #23

MEMBER LOADS

SUMMARY

TABLE III

MEMBER	CONDITION (M.F.W.LAGUNSYMGUST) @0000' REF P 240	CONDITION (M.F.W.-2,L,A,A-Unsym) GUST @5000' REF P 251
AM	-2,80"	1360"
A'M	11,000"	-8090"
B'O	14,900"	-10,280"
B'O	26,100"	-19,200"
C'Q	30,100"	-21,700"
C'Q	41,300"	-30,550"
ER	—	—
GK	-55,100"	34,150"
G'R	-40,800"	24,750"
H'P	-33,800"	20,800"
H'P	-20,800"	12,300"
I'N	-16,800"	9800"
I'N	-3600"	1100"
K'M	-9600"	6000"
K'M	600"	500"
MN	10,000"	-5600"
NO	-8800"	6400"
OP	11,200"	-6300"
PQ	-11,600"	7730"
QR	18,100"	-10,320"

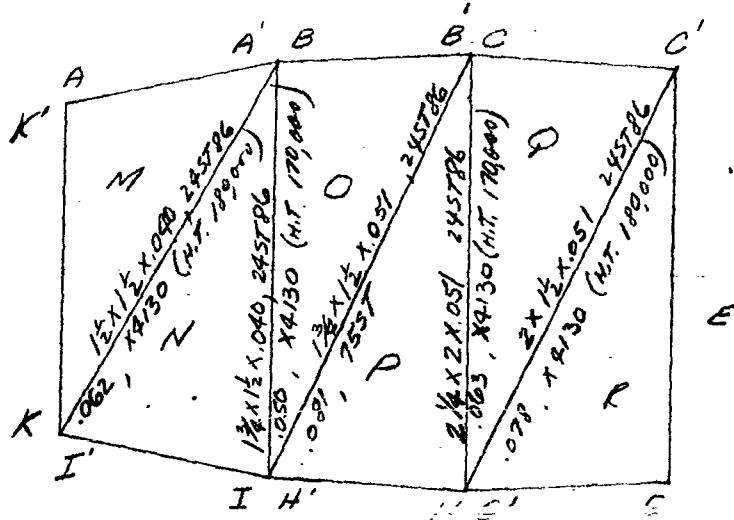
ANALYSIS WING  
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CHECKED BY Mofford  
REVISED BY

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**FORT WORTH DIVISION**  
**FORT WORTH, TEXAS**

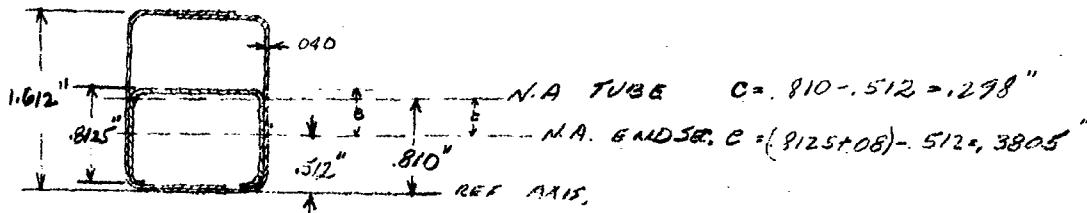
PAGE 259  
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MODEL 1B-36  
DATE

WING BULKHEAD #23

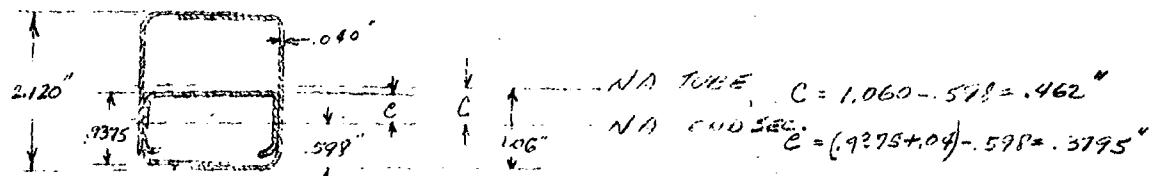
## VERTICAL + DIAGONAL MEMBERS



MEMBER MN



MEMBER NO



ANALYSIS WING  
PREPARED BY RUSSELL  
CHECKED BY Burke  
REVISED BY \_\_\_\_\_

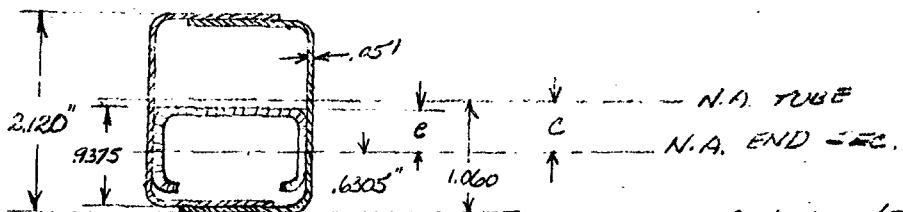
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FORT WORTH DIVISION  
FORT WORTH, TEXAS

PAGE 260  
REPORT NO. F25-36-242  
MODEL 1B-36  
DATE \_\_\_\_\_

WING BULKHEAD #23

VERTICAL & DIAGONAL MEMBERS

MEMBER OP

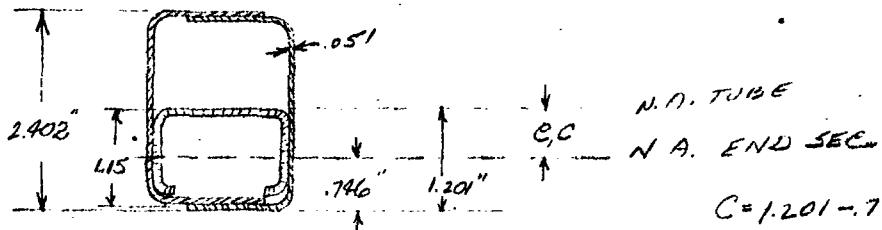


N.A. TUBE  
N.A. END SEC.

$$C = 1.060 - .6305 = .4295"$$

$$C = (9375 + .051) - .6305 = .3580"$$

MEMBER PQ

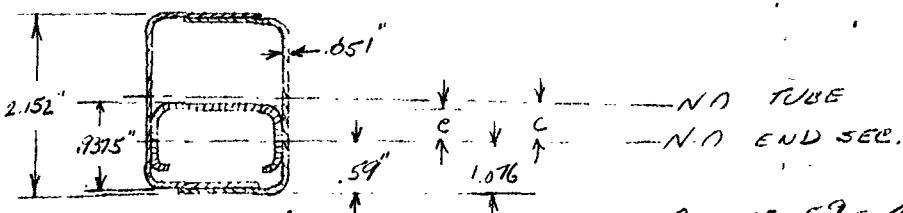


N.A. TUBE  
N.A. END SEC.

$$C = 1.201 - .746 = .455"$$

$$C = (1.15 + .051) - .746 = .455"$$

MEMBER QR



N.A. TUBE  
N.A. END SEC.

$$C = 1.076 - .59 = .486"$$

$$C = (9375 + .051) - .59 = .3985"$$

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FORT WORTH DIVISION  
FW 833 746 ENGINEERING RULED TABULATION PAD--VELLUM

TABLE  
III.

WING BULKHEAD #23  
SUMMARY OF STRESSES & M.S.  
FOR TRUSS VERT & DIAGONAL MEMBERS.

page 26

XB-36

NUMBER	AREA	TENS.	COMP.	FT.	FT.	M.S.	FT.	COLUMN LENGTH	P <sub>X</sub>	P <sub>A</sub>	F <sub>C</sub>	M.I.
		LOAD (P <sub>1</sub> )	LOAD (P <sub>2</sub> )	P <sub>1</sub> /A		(TENS)	P <sub>2</sub> /A			P <sub>A</sub>		(cu.)
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬
B	258	B	258	③/②	FES-36-NL E=220	⑥/①	④/②	FES-36-NL E=220	⑩/⑨	FES-36-NL E=220	⑫/⑪	⑬/⑭
MN	.2695	10,000	-5600	37,100	49,000	+ .32	20,800	36.5	.633	57.6	23,300	+ .12
NO	.3000	6,420	-8,800	20,900		+1.34	27,750	37.0	.808	95.8	28,800	+ .00
OP	.3060	11,200	-6,300	36,600		+ .34	20,600	42.62	.808	52.8	25,600	+ .24
PO	.4904	7730	-11,600	16,100		+2.04	29,200	41.25	.941	43.8	29,700	+ .23
QR	.3969	18,100	-10,320	45,600	49,000	+ .07	26,000	43.375	.817	53.0	25,600	- .015

whole trees

NUMBER	AREA	P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub> /P <sub>4</sub>	P <sub>5</sub> /P <sub>6</sub>	C	C	I	P <sub>7</sub> /C <sub>8</sub>	P <sub>8</sub> /C <sub>9</sub>	F <sub>10</sub> (TOM)	F <sub>11</sub> (TON)	F <sub>12</sub> (TON)	M.S.	F <sub>13</sub> (TON)	F <sub>14</sub> (TON)	M.S.
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯	⑰	⑱
MN	6978	10,000	-5600	14,350	-8020	2,980	3,805	0,825	13,750	-7700	28,100	79,300	11,14	15,720	49,300	+2.50	
NO	.5994	6400	-8800	10,710	-14,800	.4620	.3795	.0716	15,100	-21,600	26,480	74,600	+1.28	36,400	102,500	+7.51	
OP	.5771	11,200	-6300	19,400	-10,900	4,225	.3580	.0618	27,850	-15,700	47,250	133,200	+2.28	26,600	75,000	+1.07	
PQ	.9328	11730	-11,600	8300	-12,850	4,550	4,550	1,667	9,600	-14,400	17,900	50,500	+2.37	26,250	75,800	+1.04	
QR	.8848	10,100	-10,320	20,500	-11,700	4,260	3,985	1,028	34,100	-19,450	54,600	154,000	+1.10	31,150	88,000	+1.74	

\* RATIO OF E. FOR STEEL AND ALUM.

PREPARED BY: RUSSELL  
CHECKED BY: Vaughan

PREPARED BY COURTER  
CHECKED BY Refford  
REVISED BY \_\_\_\_\_

COMMUNICATED THROUGH FORT WORTH DIVISION  
FORT WORTH, TEXAS

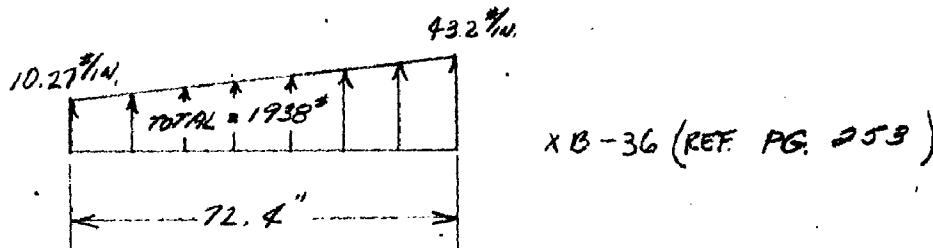
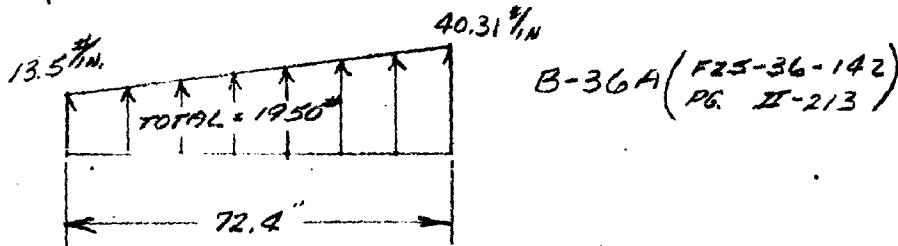
REPORT NO. LCZ-36-67  
MODEL XB-36  
DATE 5/14/47

## WING BULKHEAD #23

### UPPER CHORD (AFT POSITION)

THE UPPER CHORD ANALYSIS  
WILL BE MADE SIMILAR TO THE  
B-36A ANALYSIS (REF. F25-36-142, PG. II-234)  
THE UNSUPPORTED SKIN BETWEEN  
HAT STRINGERS IS CRITICAL.

### CHORD LOADING (I.L.A.-A.)



THE B-36A AND XB-36 CHORD LOADINGS (SEE ABOVE)  
ARE PRACTICALLY THE SAME, AND THE B-36A BEND  
STRESSES ARE VERY SMALL (REF. F25-36-142, PG. II-234).  
THEREFORE THE XB-36 CHORD B.M. WILL  
BE ASSUMED THE SAME AS THE B-36A.

ANALYSIS WING  
PREPARED BY COWLEY  
CHECKED BY MURRAY  
REVISED BY \_\_\_\_\_

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FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. F25-36-142  
MODEL XB-36  
DATE 5/48

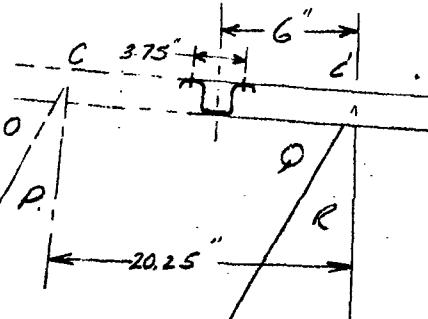
WING BULKHEAD #23

UPPER CHORD (CONT'D)

AXIAL LOAD

$$\begin{aligned} C'Q &= -30550^* \\ CQ &= -21700^* \end{aligned} \quad \left. \right\} \text{REF. P. 258}$$

$$\begin{aligned} P &= -30550 + (30550 - 21700) \frac{6}{20.25} \\ &= -27,900^* \end{aligned}$$



BEND. MOM. =  $120.8''^*$  (REF. F25-36-142, PG II-234)

USE 6" WIDTH OF .102 SKIN.

$$\text{AREA} = 1.424 + 2(.102) = 1.632 \text{ in}^2$$

$$I = 12.256 \text{ in.}^4$$

$$C = 4.11 \text{ in.}$$

$\left. \right\} \text{REF. F25-36-142}$   
 $\text{PG. II-222}$

$$\begin{aligned} f_c &= \frac{27900}{1.632} + \frac{1280 \times 4.11}{12.256} \\ &= 17,500^* \text{ sq. in.} \end{aligned}$$

$f_c = 19,000^* \text{ sq. in.}$  (REF. F25-36-142, PG II-234)

$$M.S = \frac{19000}{17500} - 1 = +.08$$

ANALYSIS WING  
PREPARED BY RUSSELL  
CHECKED BY Ward  
REVISED BY \_\_\_\_\_

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**FORT WORTH DIVISION**  
**FORT WORTH, TEXAS**

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REPORT NO. F75-36-242  
MODEL XB-36  
DATE 5/48

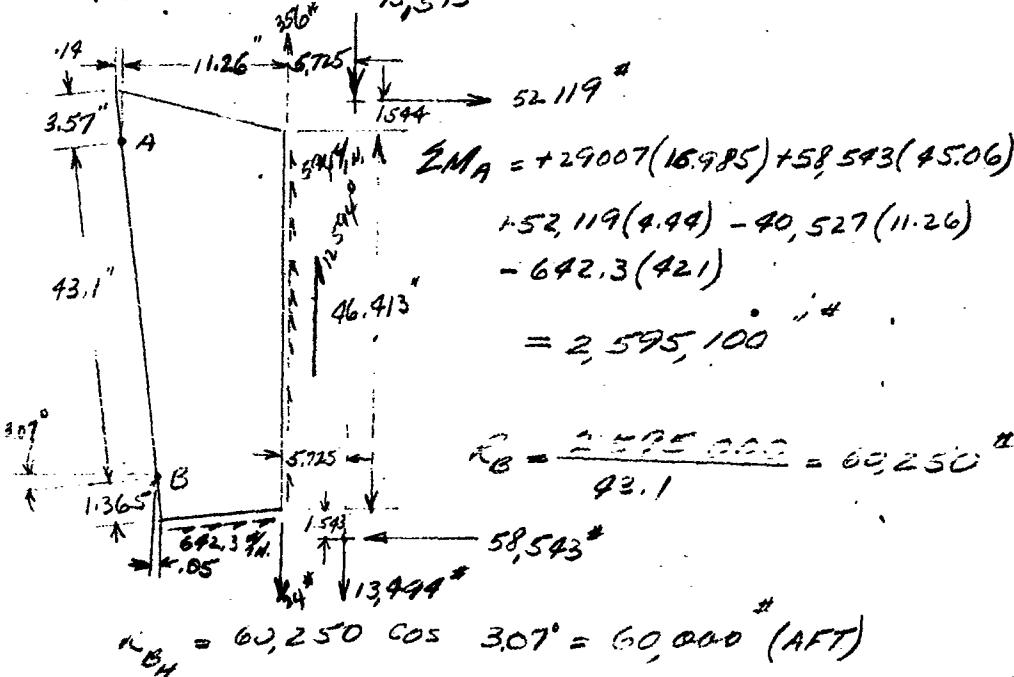
WING BULKHEAD #23

WEB SECTION

M.F.W. - L.A.A. @ 5000 FT. IS CRITICAL

REWORK AFT SECTION WITH REACTIONS  
AT CENTROIDS OF CHORDS. REF PG 258

FOR LOADS. 15.513\*



$$R_{B_4} = 60,250 \cos 3.07^\circ = 60,000 \text{ (AFT)}$$

$$R_{BV} = 60,250 \sin 307^\circ = 3230'' \text{ (P)}$$

$$\Sigma_y = 13,390^*(\nu p)$$

$$R_{AV} = 13,350 + 3230 = 16,620^{\text{H}}(\text{pounds})$$

$$\Sigma_H = -6634 \text{ (FWD)}$$

$$R_{A4}^2 = 60,000 - 6634 = 53,366 \text{ (F.W.D.)}$$

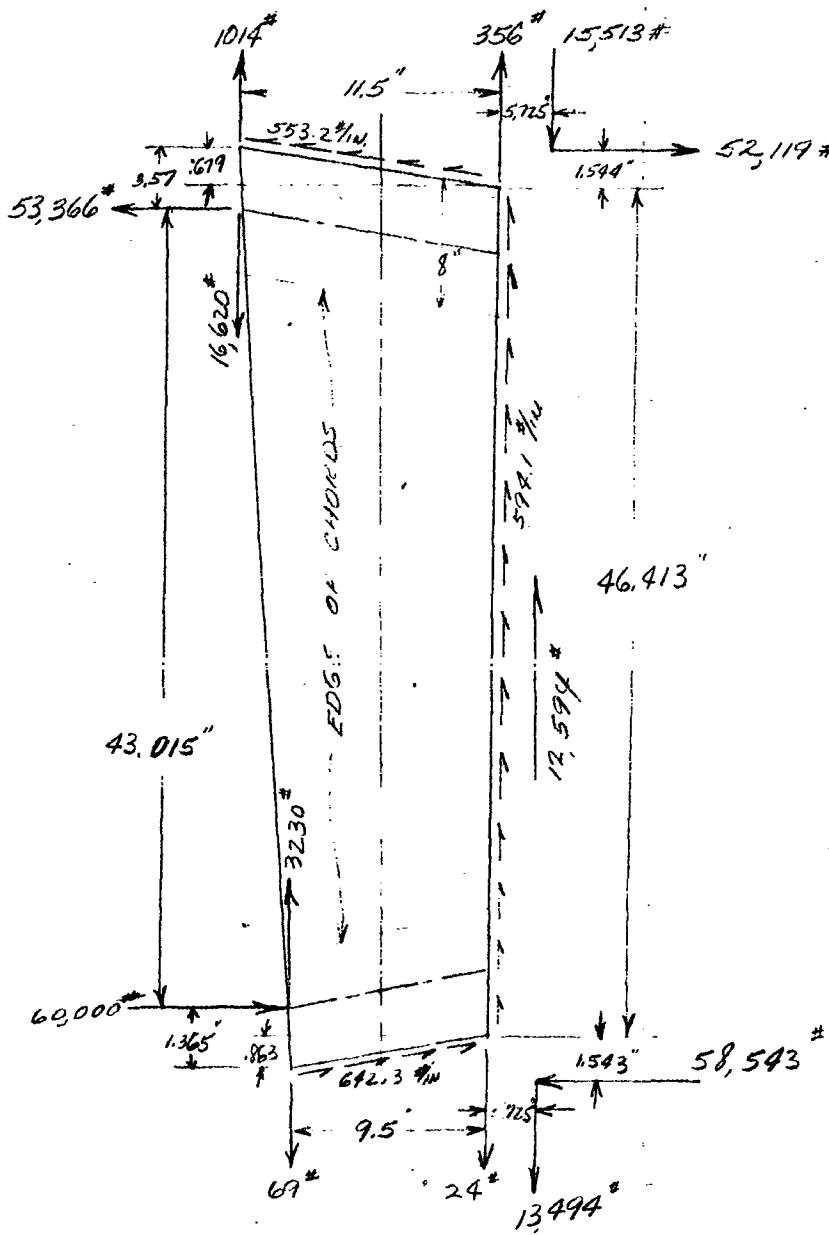
ANALYSIS WING  
PREPARED BY RUSSELL  
CHECKED BY J. F. H.  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

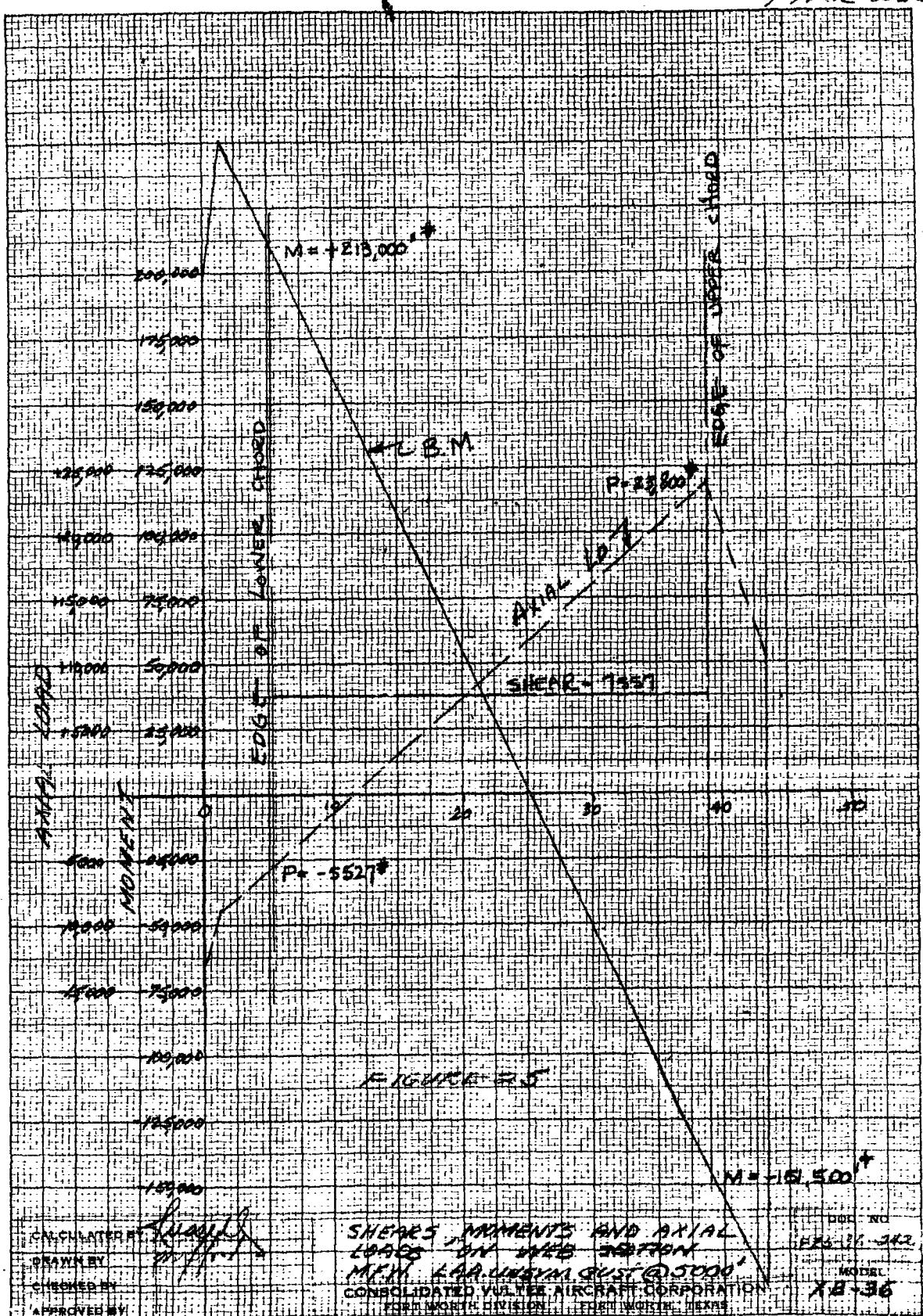
PAGE 265  
REPORT NO. FZS-36-242  
MODEL XB-36  
DATE 5-48

WING BULKHEAD #23

SUMMARY OF LOADS



FOR BENDING MOMENTS, SHEARS, AND  
AXIAL LOADS ON WEB SECTION, SEE  
FOLLOWING PAGE.



CALCULATED BY *[Signature]*  
DRAWN BY  
CHECKED BY  
APPROVED BY

ANALYSIS WING  
PREPARED BY KUSSELL  
CHECKED BY Campfield  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. F25-36-242  
MODEL 10-36  
DATE 5-48

## WING BULKHEAD #23

### WEB SECTION (CONT'D.)

#### MEMBER ER

##### ADJACENT TO LOWER CHORD

$$B.M. = +213,000 \text{ (COMP. IN ER)}$$

$$P = -5527 \text{ (TENS. IN ER)}$$

$$S = +7557 \text{ (COMP. IN ER.)}$$

$$5.25 \sin 2.27^\circ = .208$$

$$9.500 + .208 = 9.708$$

$$h' = 9.708 - .562 - .381 - 8.765$$

$$P_c = \frac{213000}{8.765} + \frac{7557 \times 1.35}{2} - 5527 \left( \frac{.12}{9.708} \right)$$

$$= 27,440^* \text{ (comp)}$$

##### ADJACENT TO UPPER CHORD

$$B.M. = -151,500 \text{ (TENS. IN ER)}$$

$$P = +23,800 \text{ (COMP. IN ER)}$$

$$S = +7557 \text{ (COMP. IN ER)}$$

$$h' = 9.62$$

$$P_c = \frac{151500}{9.62} + 5100 + 23,800 \left( \frac{.46}{10.73} \right)$$

$$= 2990^* \text{ (TENS.)}$$

ANALYSIS WING  
PREPARED BY RUSSELL  
CHECKED BY Campfield  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

PAGE 268  
REPORT NO. F25-36-242  
MODEL XB-36  
DATE \_\_\_\_\_

## WING BULKHEAD #23

### WEB SECTION (CONT'D.)

#### MEMBER ER (CONT'D.)

$$\text{AVERAGE LD. IN ER} = \frac{27,440 - 2990}{2} = 12,225 \text{ (comp.)}$$

$$f_c = \frac{12,225}{.5928} = 20,600 \text{#/in}^2$$

$f_c = 33,000 \text{#/sq.in.}$  (REF. F25-36-142, PG. II-245)

$$M.S. = \frac{33,000 - 1}{20,600} = +\underline{\underline{.60}}$$

### WEB

$$S = 7557 \text{ " (Ref. P-266) }$$

$$h = 10.3$$

$$t = .090$$

$$T = \frac{7557}{10.3 \times .090} = 18,350 \text{#/sq.in.}$$

$$T_{CR} = 2880 \text{#/sq.in.}$$

$$T_{SU} = 29,700 \text{#/sq.in.}$$

$$T_{EW} = 29,300 \text{#/sq.in.}$$

F25-36-142  
PG. II-241

$$M.S. = \frac{29,300}{18,350} - 1 = +\underline{\underline{.325}}$$

THE WEB STIFFENERS WILL BE CONSIDERED  
SATISFACTORY, BECAUSE THE MARGIN OF SAFETY ON  
THE B-36A IS LARGE.

ANALYSIS WING  
PREPARED BY LOGIREY  
CHECKED BY Mofford  
REVISED BY \_\_\_\_\_

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

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REPORT NO. F25-36-242  
MODEL XB-36  
DATE 5/3/48

## WING BULKHEAD #23

### ANALYSIS OF REAR SPAR VERTICAL.

THE ANALYSIS OF THE REAR SPAR VERTICAL FOR THE XB-36 IS MADE BY OBTAINING A CLOSE APPROXIMATION OF THE LOADS AND COMPARING THEM WITH THE B-36A LOADS (REF. PAGES 272 AND 276). THE LOADS ARE APPROXIMATED BY RATIOING THE B-36A LOADS FOR THE XB-36.

THE CRITICAL CONDITION FOR THE XB-36 IS; ALT. GROSS WT. (72-1000# BOMBS) L.A.A. @ 35,000 FT AND THE CRITICAL COND. FOR THE B-36A IS; DESIGN GROSS WT. L.A.A. @ 30,000 FT.

THE MINIMUM MARGIN OF SAFETY FOR THE REAR SPAR VERTICAL FOR THE B-36A IS +.39 (REF. F25-36-142, PG. II-266 & 268). A COMPARISON OF THE LOADS (PG. 212) WILL SHOW THAT THE XB-36 LOADS ARE APPROXIMATELY THE SAME AS THE B-36A, THEREFORE THE REAR SPAR VERTICAL WILL BE CONSIDERED SATISFACTORY AND THE B-36A M.S. WILL BE APPLICABLE.

ANALYSIS WING  
PREPARED BY L. COOPER  
CHECKED BY M. FORD  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

PAGE 270  
REPORT NO. F25-36-242-  
MODEL XB-36  
DATE 9/30/49

## WING BULKHEAD #23

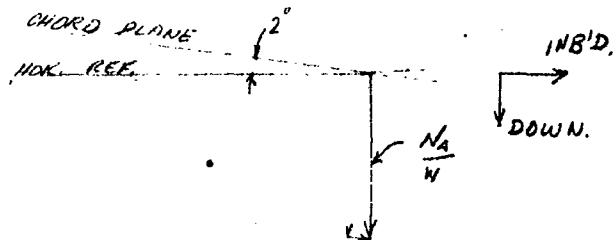
### FLIGHT INERTIA FACTORS

COND = A.G.W. - L.A.A. (72-1000# BOMBS) @ 35,000 FT.

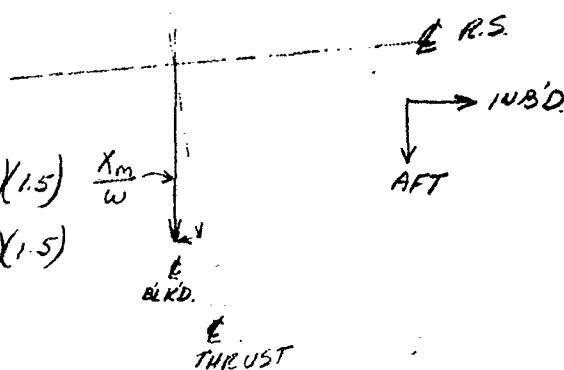
$$\begin{aligned} - \frac{N_A}{W} &= -2.668 \\ \frac{X_m}{W} &= .101 \end{aligned} \quad \left. \begin{array}{l} \text{REF. F25-36-126, PG. 67.} \\ \hline \end{array} \right.$$

RESOLVE FACTORS INTO PLANE 1 AND  
PARALLEL TO THRUST LINE.

$$\begin{aligned} N_r &= -\frac{N_A}{W} \cos 2^\circ (1.5) \\ &= -2.668 \times .99 \times 1.5 \\ &= -4.0 \text{ DOWN (ULT.)} \end{aligned}$$



$$\begin{aligned} N_d &= +\frac{X_m}{W} \cos 3^\circ (1.5) \\ &= .101 \times .9986 \times 1.5 \\ &= +.1512 \text{ AFT (ULT.)} \end{aligned}$$



$$\begin{aligned} N_s &= -\left(-\frac{N_A}{W} \sin 2^\circ + \frac{X_m}{W} \sin 3^\circ\right) (1.5) \\ &= (-2.668 \times .0399 + .101 \times .0523) (1.5) \\ &= +.1318 \text{ INBD (ULT.)} \end{aligned}$$

ULT. LOADS AT MOST FWD. POINTS OF OUTBLD BASIC ENG MT. LN & RH SIDES X-B-26  
COND.: A.G.W. (72-1000 LB/BBL) L.A.A. @ 35,000 ft.  
F2550-24  
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BASIC MT. POINTS <sup>1</sup>	$\leftarrow N_V = 4.0 \text{ DOWN} \rightarrow$			$\leftarrow N_S = 1.518 \text{ INBD.} \rightarrow$			$\leftarrow N_B = 1.518 \text{ AFT} \rightarrow$			ULTIMATE LOADS ON BASIC MOUNT			ULTIMATE THRUST ON BASIC MOUNT			TOTAL LOADS			
	V	D	S	V	D	S	V	D	S	V	D	S	V	D	S	EV	ED	SS	
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯	⑰	⑱	⑲	
N <sub>V</sub>	N <sub>V</sub>	N <sub>V</sub>	N <sub>S</sub>	N <sub>S</sub>	N <sub>S</sub>	No	No	No	No	No	No	No	No	No	No	No	No	No	
cal.①	cal.②	cal.③	cal.④	cal.⑤	cal.⑥	cal.⑦	cal.⑧	cal.⑨	cal.⑩	cal.⑪	cal.⑫	cal.⑬	cal.⑭	cal.⑮	cal.⑯	cal.⑰	cal.⑱	cal.⑲	
TAB. REF. 7198, TAB. 7198																			
A +72.8 +347.0 <sup>3</sup>	-343.0	-122L	+57L	+97	-20	+187	-79L	-36.00L	-93.2L	+177L	+64	-1135	+158L	+1150L	+25153L	-3364L			
	+343.0	+122R	-57R				+11R	+36.00R	+93.2R	-97R						-155R	+7330R	+725039R	+3558R
A' +72.28 +9.10 <sup>3</sup>	+343.24	+122L	-57L	+97	-20	+187	+62L	+36.20L	+93.2L	+177L	+64	-1135	-157L	+1040L	+135.92L	+4335L			
	-343.24	-122R	+57R				-21R	+36.30R	+93.8R	-97R						+158R	+1070R	+36.53R	+4341R
C +6667 -29.732 +349.0L -30L -1978L +363 +22 +383 +45L -3078L +7451L -772L -61	+349.0L	-30L	-1978L	+363	+22	+383	+45L	-3078L	+7451L	-772L	-61	+695	+221L	+6658L	-23.619L	+3258L			
	-3440L	+30R	-1978L				+45L	-3078R	+7451R	+72L						-221R	+6716R	-26.59R	-3032R
C' +6667 -29.732 -349.0L +30L -1978L +363 +22 +383 +45L -3078L +7451L -772L -61	-349.0L	-30R	-1978L	+363	+22	+383	+45L	-3078L	+7451L	-772L	-61	+695	-221L	+774L	-37.46L	-4245L			
	+3440R	-30R	+30R				-45R	-3078R	+7451R	+72R						+221R	+9734L	-33.670L	+4971R

L1EN CONVENTION

- (+) VERTICAL LOADS, DOWN
- (+) DRAG LOADS, AFT
- (-) SIDE LOADS, INBD.

L= DESIGNATES L.H. MOUNT.  
R= DESIGNATES R.H. MOUNT.

INITIATED BY: Tolson 4/20/48  
CHECKED BY: Moffett 5/10/48

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PREPARED BY Loyrey  
CHECKED BY Mufford  
REVISED BY \_\_\_\_\_

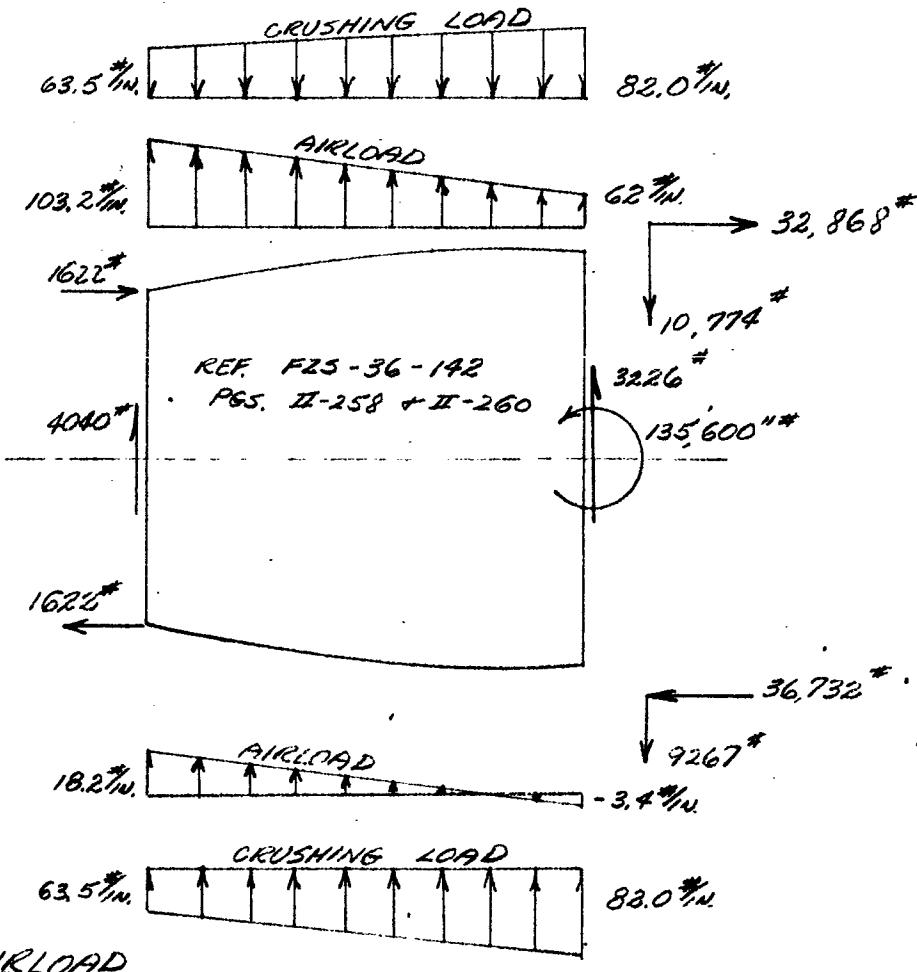
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DATE 4/30/48

## WING BULKHEAD #23

### B-36 LOADING

D.G.W. L.A.A. @ 30,000 FT.



AIRLOAD

THE XB-36 AIR LOADS WILL BE OBTAINED BY MULTIPLYING THE B-36A AIRLOADS ON WING BULKHEAD #23 BY THE RATIO OF  $\frac{Z(XB-36)}{Z(B-36A)}$ , WHERE, Z = AIRLOAD ON WING NORMAL TO CHORD LINE.

THIS PROCEDURE ASSUMES THAT THERE IS NO CHANGE IN CHORDWISE PRESSURE DISTRIBUTION BETWEEN B-36 AND XB-36 CONDITIONS.

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WING BULKHEAD #23

AIRLOADS (CONT'D)

$$B-36 A \left\{ \begin{array}{l} \frac{Z}{W} = +2.758 \\ W = 268,213^* \end{array} \right\} \text{REF. F25-36-136} \\ \text{PG. 50}$$

$$XB-36 \left\{ \begin{array}{l} \frac{Z}{W} = +2.779 \\ W = 254,793^* \end{array} \right\} \text{REF. F25-36-126} \\ \text{PG. 69}$$

$$B-36 A; Z = 738,000^*$$

$$XB-36; Z = 708,000^*$$

$$R = \frac{708,000}{738,000} = .960$$

$$(L.E) 4040 \times .960 = 3880^*$$

$$" 1622 \times .960 = 1560^*$$

$$(T.E) 3226 \times .960 = 3100^*$$

$$" 135,600 \times .960 = 130,200^{**}$$

$$(U. SURF) 103.2 \times .960 = 99 \frac{1}{4} \text{ in.}$$

$$" 62 \times .960 = 59.5 \frac{1}{4} \text{ in.}$$

$$(L. SURF) 18.2 \times .960 = 17.5 \frac{1}{4} \text{ in.}$$

$$" -3.4 \times .960 = -3.2 \frac{1}{4} \text{ in.}$$

CRUSHING LOADS

THE XB-36 CRUSHING LOADS WILL BE  
OBTAINED BY MULTIPLYING THE B-36A  
CRUSHING LOADS ON WING BULKHEAD #23  
BY THE RATIO OF  $\frac{(\text{BEND. MOM.})^2 \text{ XB-36}}{(\text{BEND. MOM.})^2 \text{ B-36}}$ .

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CHECKED BY Wright  
REVISED BY \_\_\_\_\_

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## WING BULKHEAD #23

### CRUSHING LOADS (CONT'D)

B-36A ; BEND MOM = 38,500,000 " (REF. F25-36-140)  
PG. 115

XB-36 ; BEND. MOM. = 35,750,000 " (REF. F25-36-240)  
PG. 121

$$R = \frac{(35,750,000)^2}{(38,500,000)^2} = .882$$

$$63.5 \times .882 = 56 \frac{7}{8} \text{ in}$$

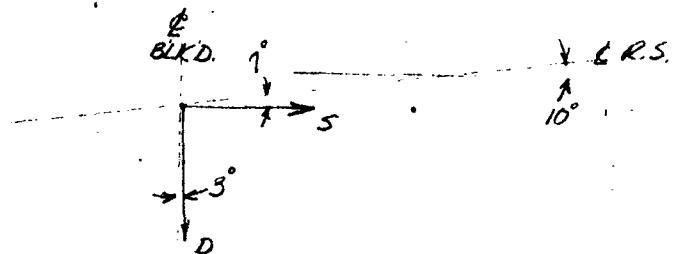
$$82.0 \times .882 = 72.3 \frac{7}{8} \text{ in}$$

### ENGINE MOUNT FITTING LOADS

UPPER FITTING (A'):  $V = 11,014^*$   
 $D = 34,421^*$   
 $S = 4535^*$  } REF. PG. 222

LOWER FITTING (C'):  $V = 9194^*$   
 $D = -37,966^*$   
 $S = -4245^*$  } REF. PG. 222

THE DRAG AND SIDE LOADS ARE RESOLVED  
INTO THE PLANE OF THE BULKHEAD AND THE  
PLANE OF THE REAR SPAR.



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## WING BULKHEAD 23

### ENGINE MOUNT FITTING LOADS (CONT'D)

#### UPPER FITTING (A'):

$$D' = 34,421 \cos 3^\circ - 4535 \sin 3^\circ = 34,163^*$$

$$S' = 34,421 \sin 3^\circ + 4535 \cos 3^\circ = 6325^*$$

$$D'' = 6325 \tan 10^\circ = 1117^*$$

$$D_{\text{TOTAL}} = 34,163 + 1117 = 35,280^*$$

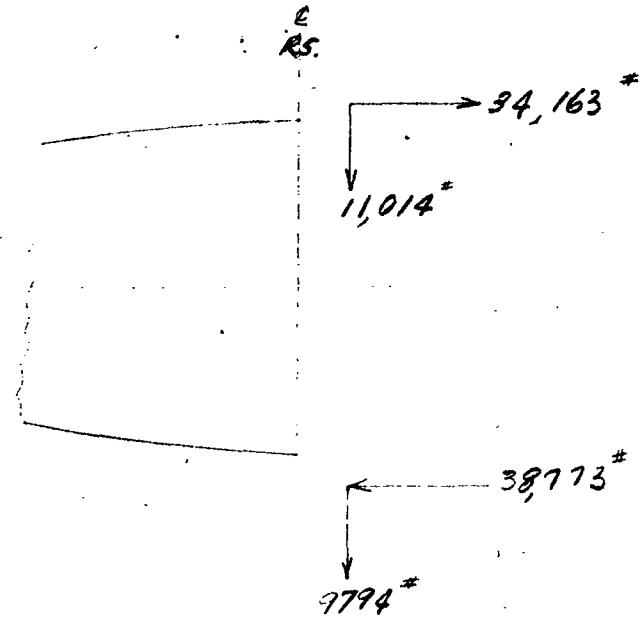
#### LOWER FITTING (C'):

$$D' = -37,966 \cos 3^\circ + 4245 \sin 3^\circ = -37,678^*$$

$$S' = -37,966 \sin 3^\circ - 4245 \cos 3^\circ = -6215^*$$

$$D'' = -6215 \tan 10^\circ = -1095^*$$

$$D_{\text{TOTAL}} = -37,678 - 1095 = -38,773^*$$



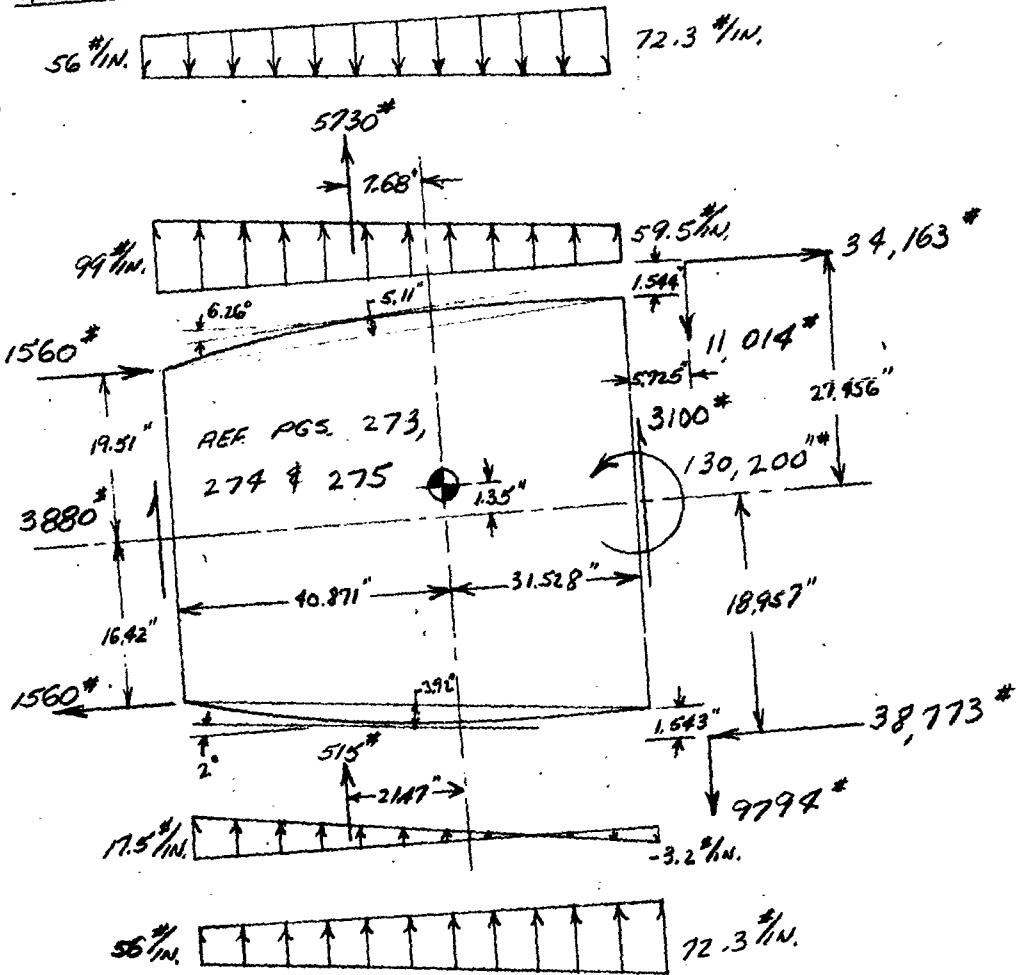
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WING BULKHEAD 23

XB-36 LOADING (ALT. G.W. 2.91A @ 35,000 FT)



SUMMATION OF LOADS ABOUT E.A.

$$V = 7583^* \text{ (DOWN)}$$

$$D = 4610^* \text{ (FWD.)}$$

$$T_{E.A} = 2,594,450^{**} \text{ (CLOCKWISE)}$$

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## WING BULKHEAD #23

### REACTIONS TO VERT. LOAD.

$$q_{FS} = \frac{7583 \times 31.53}{72.4 \times 35.94} = 92.0 \text{ } \frac{\text{lb}}{\text{in.}} (\text{UP})$$

$$q_{RS} = \frac{7583 \times 40.87}{72.4 \times 46.41} = 92.3 \text{ } \frac{\text{lb}}{\text{in.}} (\text{UP})$$

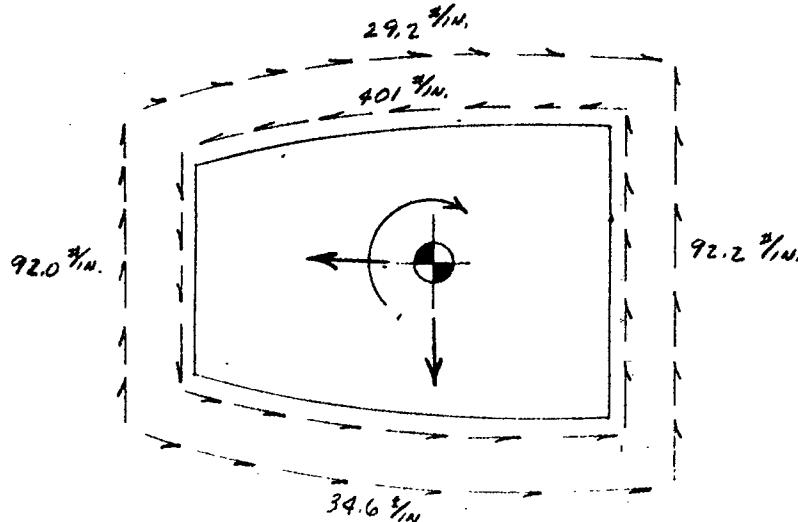
### REACTIONS TO DRAG LOAD

$$q_U = \frac{4610 \times 23.25}{50.90 \times 72.40} = 29.2 \text{ } \frac{\text{lb}}{\text{in.}} (\text{AFT.})$$

$$q_L = \frac{4610 \times 27.65}{50.90 \times 72.40} = 34.6 \text{ } \frac{\text{lb}}{\text{in.}} (\text{AFT.})$$

### REACTION TO T.E.A.

$$q_0 = \frac{2594.450}{6485.2} = 401 \text{ } \frac{\text{lb}}{\text{in.}}$$



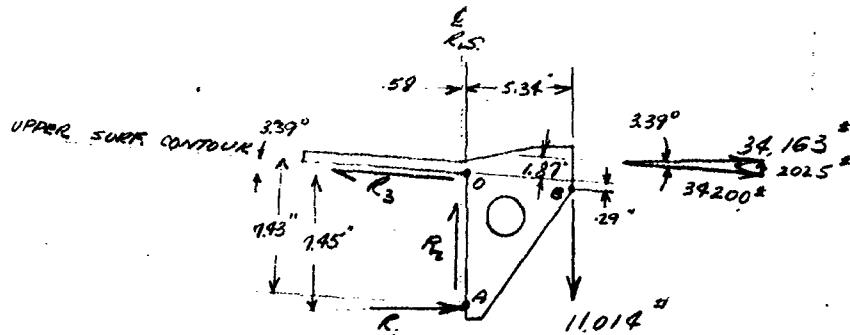
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WING BULKHEAD #23

TRANSFER OF UPPER FITTING LOADS TO BULKHEAD



$$\sum M_a = 0$$

$$7.45 R_1 = 34,200 \times 1.87 + (11,014 - 2025) \times 5.34$$

$$R_1 = 15,000^{\#} (\text{AFT.})$$

$$\sum M_b = 0$$

$$7.43 R_3 = 34,200 \times (7.43 + 1.87) + (11,014 - 2025) \times 5.34$$

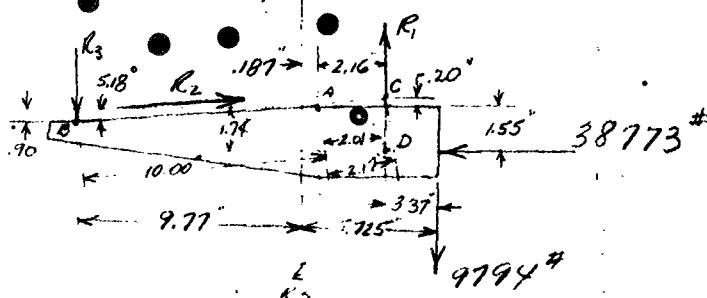
$$R_3 = 49,250^{\#} (\text{FWD.})$$

$$\sum M_c = 0$$

$$5.34 R_2 = -34,200 \times 1.87 + 15,000 (7.45 - .29)$$

$$R_2 = 8160^{\#} (\text{UP})$$

TRANSFER OF LOWER FITTING LOADS TO BULKHEAD



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WING BULKHEAD #23

TRANSFER OF LOWER FITTING LOADS TO BLKD (CONT'D)

$\Sigma M_B = 0$

$$12.12 R_1 = 38,773(1.55-.90) + 9794 \times 15.495$$

$$R_1 = 14,580^* \text{ (UP)}$$

$\Sigma M_C = 0$

$$12.17 R_3 = 38,773(1.55+.20) + 9794 \times 3.37$$

$$R_3 = 8280^* \text{ (DOWN)}$$

$\Sigma M_D = 0$

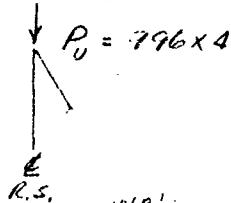
$$1.74 R_2 = -9794 \times 3.37 + 8280(10.00+2.01)$$

$$R_2 = 38,200^* \text{ (AFT)}$$

LOADS IN R.S. VERTICAL FROM SPAR ANALYSIS

FROM F25-36-241 PG. 105, THE SHEARS AT STA. #23 WERE CALCULATED AS 996 $\frac{1}{2}$ /IN. INSD. AND 1449 $\frac{1}{2}$ /IN. OUTBD. THE REAR SPAR DEPTH IS 46.413", THEREFORE THE COMPRESSIVE END LOADS ON THE MEMBER ARE:

$$P_U = 996 \times 46.413 = 46,200^*$$



$$P_L = 1449 \times 46.413 = 67,550^*$$

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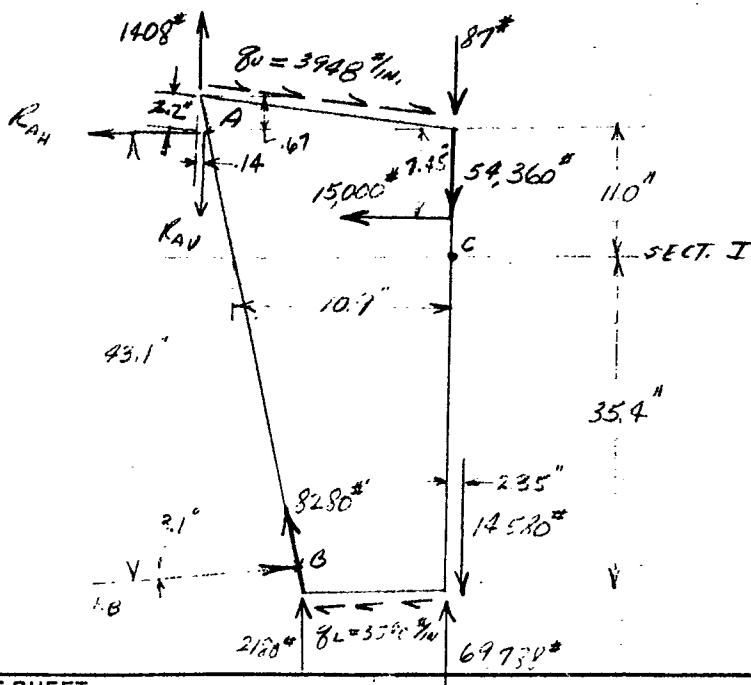
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WING BULKHEAD #23

LOAD IN R.S. VERT FROM SPAR ANALYSIS (CONT'D)

THE DIFFERENCE IN THE END LOADS (2,050<sup>#</sup>) SHOULD BE EQUAL TO THE NET BULKHEAD R.S. REACTION. FROM PG 219 THE SHEAR FLOW WAS CALCULATED TO BE 502.2  $\frac{1}{4}$ IN, OR A LOAD OF  $502.2 \times 46.413 = 23,350^*$ . THE DISCREPANCY IN LOADS OF 2200<sup>#</sup> IS DUE TO THE SLIGHTLY DIFFERENT ASSUMPTIONS MADE IN THE BULKHEAD ANALYSIS AND SPAR ANALYSIS.

IN THE ANALYSIS OF THE R.S. VERTICAL THE SHEAR FLOW AT THE R.S. CALCULATED IN THE BULKHEAD ANALYSIS WILL BE REPLACED BY THE END LOADS FOR THE SPAR ANALYSIS. THE VALUE  $P_2$  WILL BE CORRECTED TO 67,450<sup>\*</sup> TO BALANCE THE SHEAR FLOW FROM THE BULKHEAD ANALYSIS.



ANALYSIS WING  
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CHECKED BY Johansen  
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WING BULKHEAD #23

WEB PORTION REACTIONS

$$\Sigma_{MOM, A} = 1,733,349 \text{ "}$$

$$R_B \times 43.1 = 1,733,349$$

$$R_B = 40,200 \text{ "}$$

$$R_{BH} = 40,200 \cos 3.1^\circ = 40,000 \text{ " (AFT)}$$

$$R_{BV} = 40,200 \sin 3.1^\circ = 2160 \text{ " (UP)}$$

$$\Sigma V = 7889 \text{ " (UP)}$$

$$R_{AY} = -2160 - 7889 = -10,049 \text{ " (DOWN)}$$

$$\Sigma H = -4000 \text{ " (JWD.)}$$

$$R_{AH} = -40,000 + 4000 = -36,000 \text{ " (FWD.)}$$

SHEAR, MOMENT, & AXIAL LOAD AT SECT. I

$$\Sigma \text{ MOM.} = 4,100 \text{ " (CLOCKWISE)}$$

$$\Sigma V = 65,828 \text{ " (UP)}$$

$$\Sigma H = 6000 \text{ " (AFT)}$$

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WING BULKHEAD #23

BY COMPARISON OF THE XB-36 SHEAR,  
BENDING MOMENT, AND AXIAL LOAD, ON THE  
WEB PORTION OF THE BULKHEAD, (REF. PG. 266)  
WITH THE B-36A LOADS (REF. F25-36-142,  
PG. II-266) IT IS SEEN THAT THE XB-36  
LOADING IS LESS CRITICAL THAN THE  
B-36A LOADING. THEREFORE IT WILL BE  
CONSIDERED SATISFACTORY TO ASSUME THE  
B-36A R.S. VERTICAL ANALYSIS IS  
APPLICABLE TO THE XB-36.

ANALYSIS: WING  
PREPARED BY Safford  
CHECKED BY Johnson  
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LANDING GEAR SUPPORT BULKHEADS

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INTRODUCTION

Wing bulkheads 5, 7, 8 and 9 of the XB-36 Airplane equipped with the four wheel main landing gear are almost all designed by loads obtained from the Side Drift Landing or 2WL-IR-ND Landing Conditions.

It is the purpose of this section of the report to compare loads on bulkheads 5, 7, 8 and 9 for the XB-36 Airplane to those obtained for the B-36A Airplane and by means of this comparison prove that these bulkheads in the XB-36 Airplane are structurally satisfactory.

ANALYSIS Wing  
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DETERMINATION OF LOADS FOR  
LANDING GEAR BULKHEADS 5, 7, 8, AND 9

A study of Report FZS-36-142B shows that the critical conditions for the B-36A bulkheads 5, 7, 8, and 9 are:

DGW 268,000# Side Drift Landing  
DGW 268,000# 2WL-IR-ND  
AGW 255,030# (62-1000# Bombs) 2WL-IR-ND

The same conditions are critical for the XB-36 four wheel main landing gear airplane. The loads on the landing gear bulkheads are due almost entirely to the landing gear fitting loads; and the fitting loads vary directly with the weight of the airplane at landing.

CONDITION	WEIGHT AT LANDING	
	B-36A	XB-36
DGW (No Bombs)	268,000#	255,272#
AGW (62-1000# Bombs)	255,030#	255,340#

Critical wing bulkhead loads in the landing gear region of the XB-36 four wheel gear airplane due to DGW conditions will be generally 5% less than for the B-36A since  $255272/268000 = .95$  (approx.). Critical loads in this region due to AGW condition will be slightly greater than for the B-36A since  $255340/255030 = 1.001$ .

Because of the similarity and relatively small change in loads from the B-36A to the XB-36 four wheel gear airplane a detail analysis is not necessary, instead a comparative analysis based on the work shown in Report FZS-36-142 and 142B is made for each bulkhead.

ANALYSIS Wing  
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CHECKED BY Johnson  
REVISED BY \_\_\_\_\_

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BULKHEAD #5

The DGW - S.D.L. - 25% "V" into Wing Box condition is critical for bulkhead #5. The loads for the XB-36 four wheel landing gear airplane are approximately 5% less than for the B-36A, reference page 285. This bulkhead structure is identical for the B-36A and the XB-36 Airplanes; therefore, the margins of safety shown for the B-36A bulkhead, (ref. FZS-36-142B) will be increased approximately 5% for bulkhead #5 in the XB-36 Airplane.

The minimum margin of safety for bulkhead #5 of the XB-36 four wheel landing gear airplane exists in -59 web and is +5% based on the 0% margin of safety shown in FZS-36-142B, page 1.

BULKHEAD #7

The critical condition for bulkhead #7 is DGW-S.D.L. - 60% S.L. on forward wheels, 25% "V" into Wing Box. Since it has been shown that the bulkhead loads vary directly as the landing weights of the B-36A and the XB-36 Airplane, the loads on the XB-36 four wheel landing gear bulkhead #7 will decrease by the same ratio or approximately 5% from those of the B-36A shown in Report FZS-36-142B, page 19.

In the following table a comparison of the XB-36 and the B-36A minimum margins of safety for pertinent parts of the bulkhead #7 structure are shown.

TABLE IV

PART DESCRIPTION	M.S. B-36A REF: FZS-36-142B-22	M.S. XB-36 4 WHEEL G.
UPPER FLANGE	+.06	+.11
LOWER SURFACE INTERCOSTAL	+.34	+.39
LOWER FLANGE	+.04	+.09
WEBS (-8 WEB)	+.03	+.08
WEB SPLICES	+.21	+.26
STIFFENERS, #9	-.04	+.01

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CHECKED BY Johm  
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BULKHEAD #8

A.G.W. 2WL-IR-ND condition is critical for bulkhead #8. Since the difference in loads of the XB-36 and the B-36A is so small the margins of safety for the B-36A shown in FZS-36-142B page 24 will be used for the XB-36 four wheel landing gear airplane.

BULKHEAD #9

The critical condition for bulkhead #9 is DGW - Side Drift Landing - 60% S.L. on Forward Wheels - 25% "V" into Wing Box. Bulkhead loads will decrease about 5% when compared to those for the B-36A bulkhead, Ref. FZS-36-142B. The margins of safety for the XB-36 four wheel landing gear airplane bulkhead will increase an equal amount over those shown for the B-36A airplane bulkhead in the above reference.

The following table shows the minimum margins of safety for bulkhead #9 of the B-36A and the XB-36 equipped with the four wheel main landing gear.

TABLE I-V

PART DESCRIPTION	M.S. B-36A Ref.*	M. S. XB-36 4 W.G.
- 6 Web	-.004	+.046
- 7 Web	-.018	+.032
- 8 Web	+.003	+.053
- 9 Web	-.008	+.042
Inter Flange Web of Lower Chord	+.005	+.055
Riveted Connections	+.22	+.27
Chord Members	+.16	+.21
Stiffeners	-.006	+.044

\* FZS-36-142B, Page 31

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WING TRAILING EDGE  
CENTER NACELLE TO WING FUSELAGE  
INTERSECTION

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ANALYSIS *W.H.S.*  
PREPARED BY *Glenn*  
CHECKED BY *Fedorow*  
REVISED BY

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

PAGE 207  
REPORT NO. 143-646  
MODEL XB-36  
DATE 5-16-48

TRAILING EDGE INBOURD FAIRING  
TO WING FUSELAGE INTERSECTION

THE WING TRAILING EDGE STRUCTURE BETWEEN THE INBOURD FAIRING AND THE FUSELAGE FOR THE XB-36 IS IDENTICAL TO THE SAME STRUCTURE IN THE B-36A AIRPLANE. THIS IS THE CASE SINCE THE XB-36 AIRPLANE IS NOW EQUIPPED WITH THE FOUR WHEEL MAIN LANDING GEAR, REF A-A 2691. THIS ANALYSIS WILL PROVE THE STRUCTURAL STRENGTH OF THE XB-36 AIRPLANE WING TRAILING EDGE STRUCTURE BY COMPARING THE LOADS ON THE B-36A AIRPLANE TRAILING EDGE WITH THOSE FOR THE XB-36 AIRPLANE TRAILING EDGE.

SAMPLE COMPUTATIONS FOR DETERMINING THE CHORDWISE PRESSURE DISTRIBUTIONS ON THE XB-36 TRAILING EDGE ARE SHOWN ON THE FOLLOWING PAGE. AND A COMPARISON OF XB-36 AND B-36A CHORDWISE PRESSURE DISTRIBUTION OVER THE TRAILING EDGE PORTION OF THE WING, ARE SHOWN BY FIGURE 26, PAGE 292.

NO CONSIDERATION IS MADE IN THIS ANALYSIS OF THE CHANGE IN PRESSURE DISTRIBUTION FOR THE AREAS WHICH CONTAIN PROTRUSIONS IN THE WING SURFACE, NECESSARY FOR FAIRING IN THE FOUR WHEEL GEAR, IN RETRACTED POSITION. THIS IS LEGITIMATE SINCE THE INTENT IS TO COMPARE XB-36 AND

ANALYSIS WING  
PREPARED BY Chapman  
CHECKED BY \_\_\_\_\_  
REVISED BY \_\_\_\_\_

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MODEL XB-26  
DATE \_\_\_\_\_

B-26 PRESSURE DISTRIBUTIONS AND  
THE RATIO OF THE COMPARATIVE  
PRESSURES FOR THE TWO AIRPLANES  
WILL REMAIN PRACTICALLY UNCHANGED  
IN THE AREAS CONTAINING PROPOSED PARKS.  
REF. FIG. 2-36-148 B. PAGES 38, 39, 40 & 42.

ANALYSIS Wing  
PREPARED BY Johnson  
CHECKED BY Johnson  
REVISED BY

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PAGE 291  
REPORT NO. F25-36  
MODEL XB-36  
DATE

WING THERMAL EDGE BETWEEN  
STA. #2 & STA. #8

DETERMINATION OF CHORD SURFACE  
PRESSURES

- D.W. = 1.64 - 5000'

$$\beta_2 = 0.7528, \quad g = 213.1 \text{ (REF. F25-36-136, P35)} \\ M = .416 \text{ USE } M = .40$$

$$\text{STA. #2 } C_{l\infty} = .928 \quad C_{l0} = +0.026 \text{ (REF. F25-36-138 P. 14 & 15)}$$

$$C_{lw} = 0.928(.7528 + 0.026) = 0.725$$

$$\text{STA. #8 } C_{l\infty} = 0.464 \quad C_{l0} = 0.023$$

$$C_{nw} = 0.964(.7528) + 0.023 = 0.747$$

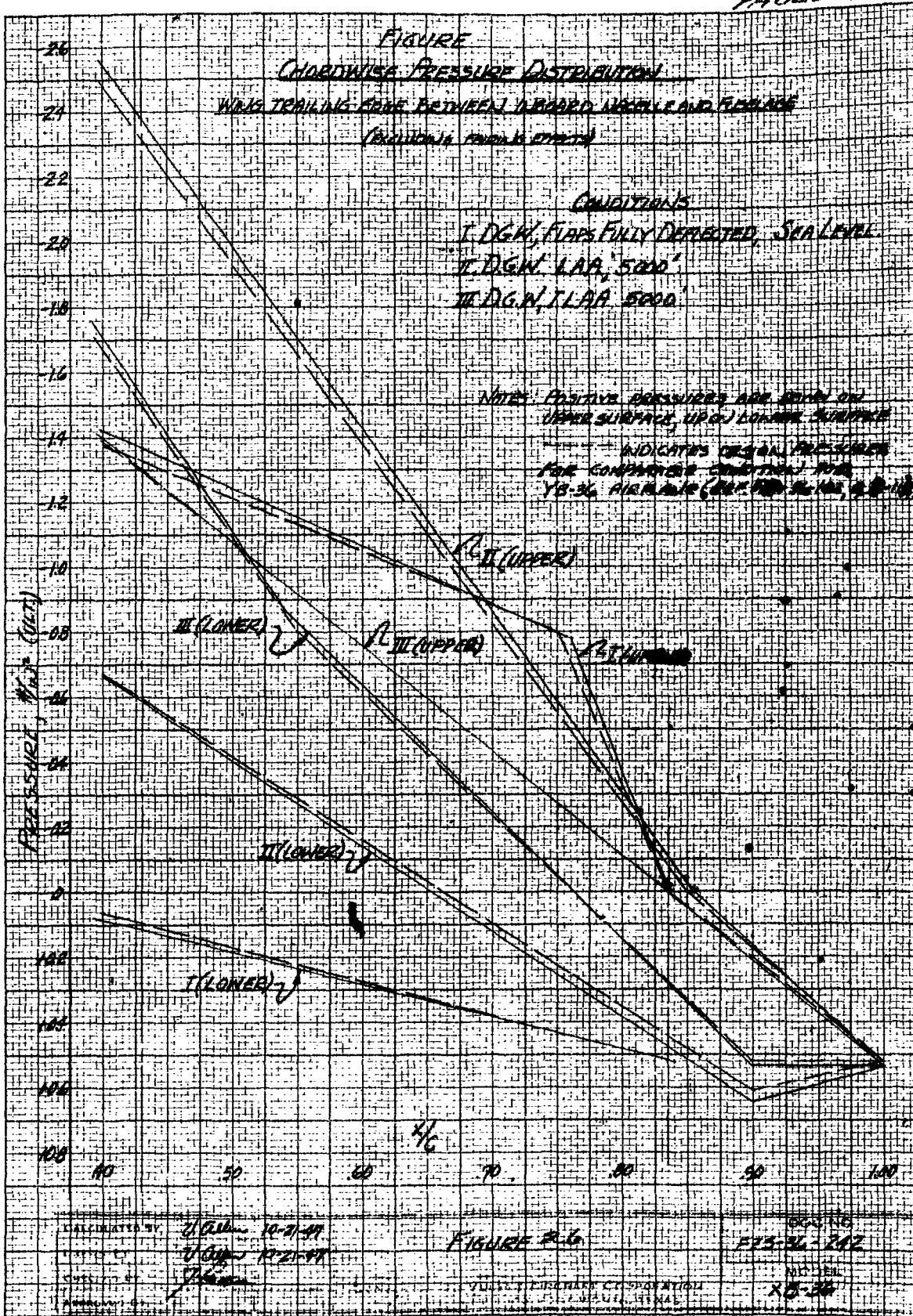
$$\mu_{100} C_{nw} = +0.737, \quad \Delta P = \frac{1.5 \times 213.1}{144} \frac{\Delta P}{g} = 2.22 \frac{\Delta P}{g} \text{ lb/ft}^2$$

FROM F25-36-142 PG. 1-16 & 1-17

TABLE LVI

% C	$\Delta P$ (PSI)	$\Delta P$ (PSI)	$\Delta P$ (PSI)	$\Delta P$ (PSI)
(1)	(2)	(3)	(4)	(5)
40	-1.15	-2.555	-0.30	-1.665
50	-0.895	-1.935	-0.18	-1.40
60	-0.65	-1.40	-0.04	-1.0?
70	-0.385	-0.855	+0.04	+0.0?
80	-0.14	-0.21	+0.16	+0.355
90	+0.05	+1.65	+0.29	+1.645
100	+0.34	+2.25	+0.34	+1.525

CHORDWISE PRESSURE DISTRIBUTION IS UNCHANGED  
FOR ALL WING SPANS, NO. 1 AND 2 MANUFACTURERS.



ANALYSIS WING  
PREPARED BY Johnson  
CHECKED BY Johnson  
REVISED BY

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FORT WORTH, TEXAS

PAGE 293  
REPORT NO. FES-36-262  
MODEL XB-36  
DATE 5-11-68

THE 52 1/2 % BEAM (36W4273)

THE 52 1/2 % BEAM IN THE XB-36 IS IDENTICAL TO THE 50 1/2 % BEAM IN THE B-36A, (36W4273). FOR A DISCUSSION OF ITS FUNCTION AND STRUCTURAL DESIGN, REF. FES-36-142, PAGE III-14.

THE CRITICAL LOADING CONDITION FOR THE BEAM IS DGW-LAMP 5000'. A STUDY OF FIG. 26 PAGE 142 SHOWS THAT THIS CONDITION YIELDS LOADS FOR THE XB-36 APPROXIMATELY 3% GREATER THAN FOR THE B-36A.

A REVIEW OF LOW MARGINS OF SAFETY, SHOWN IN THE B-36 ANALYSIS, IS MADE BASED ON THE INCREASE OF XB-36 OVER B-36 AIRLOADS.

(WEB SECTION -50 T-6, STA 90.4)  
B-36A M.S. = .065 REF. FES-36-142B P. 76

$$M.S. (XB-36) = \frac{(1.065)}{1.03} = \underline{\underline{1.035}}$$

(WEB TO FLANGE ATTACHMENT)  
B-36A M.S. = .065 REF. FES-36-142B P. 77

$$M.S. (XB-36) = \frac{(1.065)}{1.03} = \underline{\underline{1.035}}$$

XB-36 MARGINS OF SAFETY ARE IN FULL PROPORTION TO THIS BEAM. MAY BE INFLUENCED BY REDUCTION IN THE B-36A MARGINS BY 3%, IN THE MANNER SHOWN IN THE E. APPROX. FES-36-142B STA 73 TO 79

ANALYSIS WING  
PREPARED BY C. L. Johnson  
CHECKED BY J. H. Johnson  
REVISED BY

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FORT WORTH, TEXAS

PAGE 294  
REPORT NO. FES-36-242  
MODEL XB-36  
DATE 5-10-48

THE 65% BEAM (36W4834)

THE 65% BEAM IN THE XB-36 IS THE SAME MEMBER (36W4834) AS USED IN THE B-36 AIRPLANE. INFORMATION ON ITS STRUCTURAL PROPERTIES AND FUNCTIONS CAN BE FOUND IN FES-36-1436, PAGES 81, 83.

LOADINGS FROM DYN-LAB - @ 5000' CONDITION ARE CRITICAL FOR THE DESIGN OF THIS BEAM AND A STUDY OF THIS CONDITION, REF FIG 26 PAGE 292 SHOWS THE XB-36 LOADING TO BE APPROXIMATELY 3% GREATER THAN FOR THE B-36.

ALL MARGINS OF SAFETY OF THE BEAM ON THE B-36A ARE SUFFICIENTLY GREAT SO THAT INCREASING THE LOAD 3% WILL NOT CRITICALLY LOWER THE MARGINS. THE MINIMUM MARGIN OF SAFETY FOR THE B-36A 65% BEAM IS 4.10 IN THE LOWER FLANGE. (REF. FES-36-1436, PAGE 94) THE MARGIN OF SAFETY FOR THE SAME MEMBER IN THE XB-36 IS SHOWN BELOW.

$$M.S._{XB-36} = \frac{(1 + 11)}{(1.03)} - 1 = .08$$

REF. FES-36-1436, PAGE 81 TO 96 TO OBTAIN DATA.

ANALYSIS *Villy*  
PREPARED BY *Chapman*  
CHECKED BY *Johnson*  
REVISED BY

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FORT WORTH, TEXAS

PAGE 295  
REPORT NO. FZS-3624C  
MODEL XB-36  
DATE 5-11-48

## THE DIAGONAL BEAM, 36W282

THE DIAGONAL BEAM (36W282) IN THE XB-36 WITH TRAILING EDGE IS IDENTIFIED TO THE SAME MEMBER IN THE B-36A AIR PLANE. THE DESIGN, SIZE AND METHOD OF ANALYSIS OF THIS MEMBER IS GIVEN IN REPORT FZS-36-142 PAGE II-113.

THE CRITICAL CONDITION FOR THIS BEAM IS

O.G.W. FLAKS DOWN @ 50% LEVEL.  
THIS CONDITION YIELDS LOADS WHICH AVERAGE LESS THAN 1% GREATER THAN FOR THE B-36A AIRPLANE.  
REF. THE CORRECTIVE PRESSURE CURVES GIVEN ON PAGE 292.

SINCE THE INCREASE IN LOADS IS NO GREATER THAN INDICATED ABOVE, THE B-36A MARGINS OF SAFETY ARE CONSIDERED TO BE APPLICABLE FOR THE XB-36 AIRPLANE.

ANALYSIS WING  
PREPARED BY Chapman  
CHECKED BY Johansen  
REVISED BY

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FORT WORTH DIVISION  
FORT WORTH, TEXAS

PAGE 296  
REPORT NO. FES-36-242  
MODEL XB-36  
DATE 5-11-48

THE HURRICANE SPAR, 36W275

THE HURRICANE SPAR (36W275) USED  
IN THE XB-36 AIRPLANE IS IDENTICAL  
TO THAT IN THE B-36A AIRPLANE.  
A DISCUSSION AND METHOD OF  
ANALYSIS FOR THIS BEAM IS  
GIVEN IN REPORTS FES-36-143 P II-154  
AND FES-36-143B P 118.

THE CRITICAL CONDITION FOR THE  
DESIGN OF THE HURRICANE SPAR IS  
D.G.W. FLAPS DOWN @ 50% LEVEL.  
A STUDY OF LOADS FROM FIG. 26 SHOWS  
THAT THE LOADS ON THIS  
MEMBER HAVE INCREASED LESS  
THAN 1% OVER THE B-36A  
LOADS.

SINCE THE INCREASE IN LOADS  
IS NO GREATER THAN INDICATED  
ABOVE THE B-36A MARGINS OF  
SAFETY ARE APPPLICABLE TO  
THE XB-36 AIRPLANE.

ANALYSIS VINIS  
PREPARED BY J. H. H.  
CHECKED BY J. H. H.  
REVISED BY

Consolidated Vultee Aircraft Corporation

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FORT WORTH, TEXAS

PAGE 297  
REPORT NO. F25-36-342  
MODEL XB-36  
DATE 5-11-43

TE. BULKHEAD NO. 8

TRAILING EDGE BULKHEAD NO. 8 (36W273)  
IS IDENTICAL TO TRAILING EDGE  
BULKHEAD NO. 3 ON THE B-36 AIRPLANE.  
A DISCUSSION OF ITS FUNCTION  
AND STRUCTURAL DESIGN IS FOUND  
IN REPORT F25-36-142 PAGE III-252

THE APPLIED LOADS TO TRAILING EDGE  
BULKHEAD #3 FOR THE B-36A AIRPLANE  
IN THE

D.G.W. FLAPS DOWN @ SEA LEVEL COND.  
ARE GIVEN ON PAGE 68 OF REPORT  
F25-36-142B. THIS REFERENCE SHOWS  
THE NET VERTICAL LOAD ON THE  
BULKHEAD TO BE

$$\Sigma V = 14,901 \text{ #}$$

AND THE MOMENT OF THE APPLIED  
LOADS ABOUT THE REAR SHR

$$\Sigma M = -244,380 \text{ " #}$$

IN A SIMILAR MANNER THE APPLIED  
LOADS TO THE XB-36 AIRPLANE ARE  
FOUND TO BE

$$\Sigma V = 69133 \text{ #}$$

$$\Sigma M = -2452310 \text{ " #}$$

IN THE SITUATION EXISTING AT  
BULKHEAD #2 AND THE

DOWN LANDING POSITION

ANALYSIS Wing  
PREPARED BY Chapman  
CHECKED BY J. Johnson  
REVISED BY

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FORT WORTH, TEXAS

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REPORT NO F2S-36-242  
MODEL XB-36  
DATE 5-26-48

T.E. BLKHD. #8

AND THE FOLLOWING LOAD IMPACIION  
MAY BE MADE.

B-36A XB-36

21 20,709 21,153

2 MR.S. - 2,632,39.0 2,900,180

REF. F2S-36-143.B P.68

THE CALCULATIONS OF REACTIONS FOR THE  
INBORED TRAINING EDGE SECTION 15  
ACCOMPLISHED AS SHOWN IN PAGE 51  
OF F2S-36-142, VOL III. THE NET EFFECT  
OF THE ADDED LOADS TO BULKHEADS  
#2 AND #8 WILL BE AN INCREASE OF  
LESS THAN 1% IN THE SHEAR AND  
MOMENT VALUES FOR THESE MEMBERS  
IN TENS.

LIGHT FLAPS DOWN ONLY COND.

SINCE THE INCREASE IN APPLIED LOADS  
IS NO GREATER THAN INDICATED, THE  
B-36A ANALYSIS AND MARGINS OF  
SAFETY WILL BE APPLICABLE FOR  
THE XB-36 AIR PLANE, TRAINING  
EDGE BULKHEAD NO. 8.

ANALYSIS W.H.J.  
PREPARED BY Jackson  
CHECKED BY Johansen  
REVISED BY

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FORT WORTH, TEXAS

PAGE 299  
REPORT NO. F25-3-243  
MODEL XB-30  
DATE 5-11-48

T.E. BUCKHEAD NO. 2 (36W291)

TRAILING EDGE BUCKHEAD NO. 2 IS THE  
SAME BUCKHEAD AS IN THE XB-30  
AIRCRAFT. REFERENCE REPORTS  
F25-3-143, P. III-188 AND  
F25-3-143B, P. 104 SHOWS THE  
GREATEST PORTION OF THIS BUCKHEAD  
IS CRITICAL FOR THE

D.G.M. FLAPS DOWN cond.

HOWEVER THE TIE-IN PORTION AT THE  
LEADING EDGE END OF THIS BUCKHEAD IS  
ALLEGEDLY CRITICAL FOR THE

D.G.M.-LAM-5000' LND.

ANOTHER LOWER SHOCK JUST MFT OF  
THE TIE TO THE 52 1/2% BEAM IS

CRITICAL FOR THE

D.G.M.-LAM-5000' LND.

A STUD OF THE LOADS TO BUCKHEAD

(NO. 2) TO DETERMINE THE EFFECT  
OF INCORRECT LAMBERTSON'S  
LOADING

PROCESS #2 AS SHOWN IN F25-26, P. 292  
SHOWS:

1. D.G.M. FLAPS DOWN @ 54 LEVEL LND.  
AN ALLEGEDLY CRITICAL SECTION  
THAT IS NOT SEE PAGE 298

2. D.G.M.-LAM-5000' LND.  
CHANGES IN LEADING EDGE LOADING  
ARE SMALL. REF PAGE 4

3. D.G.M.-LAM-5000' LND.  
AN ALLEGEDLY CRITICAL  
SECTION OF HOLE IN A HTG-13. IT IS  
INDICATED E, PRESENT IN PH. 4  
THE LEADING EDGE IS THE FLAPS #2

ANALYSIS LINKE  
PREPARED BY Jugman  
CHECKED BY Johnson  
REVISED BY

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FORT WORTH, TEXAS

PAGE 300  
REPORT NO. 52-30-243  
MODEL B-36  
DATE 5-17-48

TE-BURG #2

10' - 15' M. S. FOR THE  
D.G.W. L.H.B. @ 5000 LBS.

THE B-36 AIRLOADS.

REF FDS-36-1428 PP. 108-110 SHOWS  
THIS MEMBER TO HAVE A MARGIN  
OF SAFETY OF (+.13). SINCE THE  
BULKHEAD IS SWING, BENDING MOMENT  
AND AxIAL LOAD AT THIS POINT  
FOR THE XB-36 IS UNKNOWN, IT  
IS ADVISED IN PRODUCTION TO THE  
INCREASE IN BULKHEAD LOADS, WHICH  
ARE DETERMINED BY USE OF THE  
PRESSURE DISTRIBUTION CURVE, P. 4.  
MARGINS OF SAFETY FOR THE XB-36  
MEMBERS MAY BE OBTAINED BY  
LEAVING THE B-36 MARGINS OF  
SAFETY BY THE LAT. O OF B-3-A  
AIR LOADS TO XB-36 AIRLOADS.

THE XB-36 MARGIN OF SAFETY FOR  
THE LOWER FLANGE AT A SECTION  
15' AFT OF THE 52 1/2% BEAM IS  
M.S. = (+.13), REF. FDS-36-1428 PP. 110  
THE MARGIN OF SAFETY FOR THE  
SHAME MEMBER IN THE XB-36 IS

(.13+.12) = .25  
100

Since THE MARGIN OF SAFETY FOR THE  
OTHER 100' OF FLANGE IS 25% AND  
TYP. 115, THE B-3-A MARGINS  
ARE THE SAME.

ANALYSIS WINST  
PREPARED BY C. G. COOPER  
CHECKED BY J. L. HAMER  
REVISED BY

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FORT WORTH, TEXAS

PAGE 301  
REPORT NO FZS-36-242  
MODEL XB-36  
DATE 5-12-48

TRAILING EDGE, INSCATED TO CENTER NACELLE

T.E. BULKHEAD NO. 12

TRAILING EDGE BULKHEAD NO. 12 IS  
IDENTICAL TO THE SAME STRUCTURE  
IN THE B-36A. FOR A DISCUSSION OF  
ITS FUNCTION AND STRUCTURAL  
PROPERTIES REFER TO REPORT  
FZS-36-142.

THE CRITICAL DESIGN CONDITION  
FOR THE MAJOR PORTION OF  
THE BULKHEAD IS

D.W. FLOOR FULLY DEFLECTED @ S.L.

REFERENCE TO THE ANALYSIS OF  
LOADS ON T.E. BULKHEADS NO. 2  
AND NO. 8 PAGE 297 SHOWS AN  
INCREASE OF LOADS OF LESS  
THAN 1%. THIS AMOUNT OF  
INCREASE MAY BE CONSIDERED  
TYPICAL FOR T.E. BULKHEAD #12.

MEMBERS WITH THE LOWEST  
MARGINS OF SAFETY IN THE  
B-36A ANALYSIS WILL BE GIVEN  
FURTHER CONSIDERATION IN  
THIS ANALYSIS.

MEMBER T-1

(REF. SKETCH, PAGE 302)

MEMBER T-1 HAS A MARGIN OF  
SAFETY OF +.06 FOR THE B-36A.  
THERE IS CONSIDERED TO BE NO  
CHANGE FOR THE XB-36 SINCE THE

ANALYSIS WING  
PREPARED BY Chung  
CHECKED BY Johansen  
REVISED BY

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PAGE 302  
REPORT NO Fis-3-242  
MODEL XB-36  
DATE

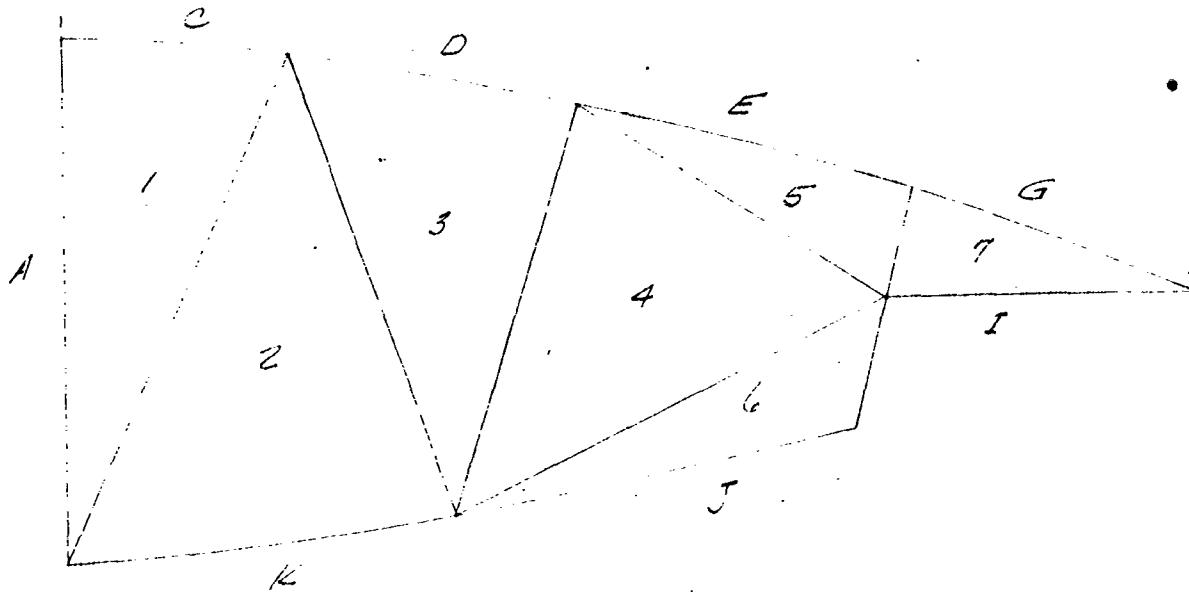
T.E. BLKHD. #12

LOADS IN MEMBER J-1 ARE A  
DIRECT FUNCTION OF FLAP LOADS  
WHICH REMAIN UNCHANGED; REF. F25-36-248

MEMBER J-6

MEMBER J-6 HAS A MARGIN OF  
SAFETY OF 1.01 FOR THE B-36A.  
THIS IS A CONSERVATIVE ANALYSIS  
SINCE IT DOES NOT CONSIDER THE  
ABILITY OF THE LOWER SURFACE  
WAFFLED SKIN TO CARRY A PORTION  
OF THE LOWER SURFACE AIR LOAD  
APPLIED TO THIS MEMBER. FOR  
THIS REASON THE B-36A MARGIN  
OF SAFETY IS APPLICABLE TO  
THE XB-36.

\$  
B.S.



ANALYSIS *Initials*  
PREPARED BY *Initials*  
CHECKED BY *Initials*  
REVISED BY *Initials*

Consolidated Vultee Aircraft Corporation  
FORT WORTH DIVISION  
FORT WORTH, TEXAS

PAGE 303  
REPORT NO. FW-5-162  
MODEL YB-32  
DATE 5-13-48

TE. 65 NO. 16

1. THE TAIL FIN STAB. IS TO BE 10' FOR 20'  
10' LENGTH TO THE CHORD CENTER LINE  
AT THE R. P. C. ON A SCAFFOLD SET UP  
THIS IS THE STANDARD FOR THE  
20'-0" TAIL FIN. (See Fig. 43, Page 23-44).

THREE BONDED SHEETS OF PLASTIC ARE REQUIRED  
IN THE FIN STAB. IN THIS SCAFFOLD.

• DOOR - FUSELAGE  
WHICH IS SHOWN IN FIG. 11. MEMBERS  
• - 2, 3-5, 4-6-5, (REF. FW-5-16-12, PG. III-422)

• DOOR - L.H.A. & FUSELAGE  
WHICH IS SHOWN FOR THE THREE  
SHOULDER MEMBERS AND MEMBERS 3-4.

• DOOR - R.H.A. & FUSELAGE  
WHICH IS CRITICAL FOR THE THREE  
SHOULDER MEMBERS.

THE SURFACE PRESSURES ON THE  
Nose FIN AND Tail. ARE AS FOLLOWS:  
DOOR - L.H.A. & FUSELAGE

ARE GIVEN IN FIG. 5 II-24 OR  
REF. FIG. 5-16-12. THE REFERENCE  
TO THE SURFACE PRESSURE  
TO BE R.50 IN H<sub>2</sub>O AT 60° OF THE SHOULDER  
FROM THE SURFACE ALONE AND 1515 # IN  
H<sub>2</sub>O AT 60° OF THE SHOULDER FROM THE  
WING IN FLIGHT. THE 18-50  
PRESSURE IS TO BE APPLIED  
DURING THE TESTS. THE 1515# IS  
TO BE APPLIED DURING THE TESTS  
WHICH ARE GOOD. AND

ANALYSIS WING  
PREPARED BY J. M. M.  
CHECKED BY J. L. T.  
REVISED BY \_\_\_\_\_

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FORT WORTH DIVISION  
FORT WORTH, TEXAS

PAGE 304  
REPORT NO. FW 5-56-242  
MODEL XB-36  
DATE 5-48

T.E. E18 #13

TEST FLIGHT NUMBER TWO  
AT 43 1000 FEET TEST OF  
2500 LB. LOADS ON THE  
UNDER CANTER OF THE XB-36.  
TEST FLIGHT NUMBER ONE  
IN A XB-36 WAS MADE AT 43 1000  
FEET AND LOADS OF 2000 LB.  
TEST FLIGHT NO. 2 IN THE XB-36  
AT 43 1000 FEET TEST OF  
2500 LB. LOADS ON THE  
UNDER CANTER OF THE XB-36.

TEST FLIGHT NUMBER THREE

TEST FLIGHT DOWN 2000 LB. EXT.  
LOADING IN THE UNDER CANTER OF THE XB-36  
ON THE EXCEPTOR NO. 1 AND NO. 3  
TEST FLIGHT NUMBER FOUR  
2500 LB. LOADS ON THE CANTER OF THE XB-36.  
THIS  
TEST WAS TO INCREASE THE XB-36  
SIDESIDE STABILITY. FOR ALL THE XB-36  
TESTS THE XB-36 IS STABLE.

TEST FLIGHT NUMBER FIVE, DGW 1000 @ 5000'

IN THIS TEST NUMBER FIVE FOR  
TEST FLIGHT NUMBER FIVE, BY COMPARISON OF  
XB-36 AND XB-50 LOADS ON THE  
UNDER CANTER TEST NO. 1000 FEET IT IS  
FOUND THAT RELEASES OF LOADS  
FOR THIS TEST ARE AS FOLLOWS:  
SIXTY FEET HIGH WHICH IS FOR SAFETY  
FOR THE XB-36 AND HARMLESS  
TO THE XB-36.

ONE TEST NUMBER SIX THIS  
TEST FLIGHT NUMBER SIX LOADS ON THE  
UNDER CANTER TEST

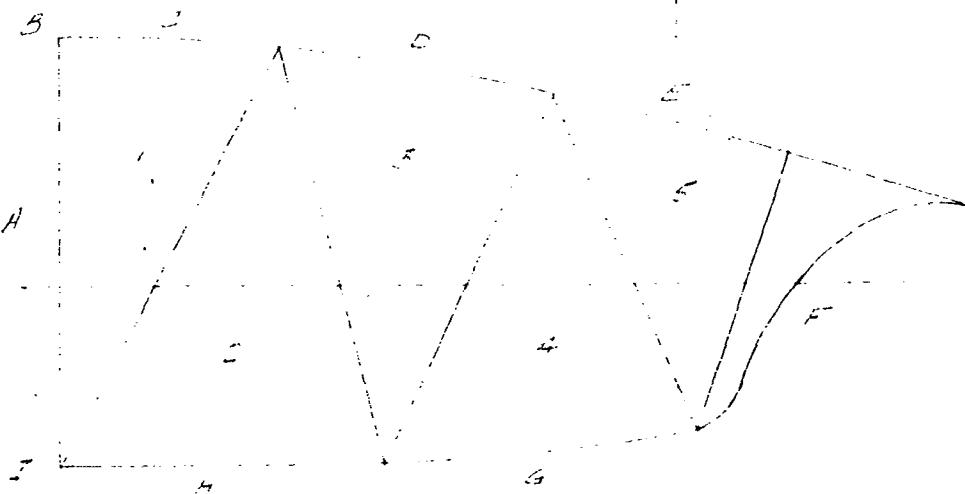
ANALYSIS W.H.S.  
PREPARED BY L. L. G.  
CHECKED BY J. H. H.  
REVISED BY \_\_\_\_\_

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FORT WORTH DIVISION  
FORT WORTH, TEXAS

PAGE 3 "5  
REPORT NO. FW 444-6-46  
MODEL A-5  
DATE 5-13-43

T.E. R.B. #13

WILL BE USEFUL IN THE SAME TIME  
INTERVAL BETWEEN XB-36 AND  
EVEN LOADS FOR CONDITIONS I AND III  
IS VERY CLOSE.



OFFICE OF THE CHIEF OF STAFF

VENTURE	LOAD	TIME
E-1	7.04	0
E-3	7.15	7.1
E-5	7.85	7.87
E-4	7.92	7.93

\* XB-36 LOAD = (E-5 + E-4) / 2

BY W.H.S. IN THE NAME OF THE CHIEF OF STAFF

ANALYSIS Wing  
PREPARED BY Norford  
CHECKED BY T. J. Morris  
REVISED BY \_\_\_\_\_

**Consolidated Vultee Aircraft Corporation**  
**FORT WORTH DIVISION**  
**FORT WORTH, TEXAS**

PAGE 3  
REPORT NO. FES-36-242  
MODEL YR-36  
DATE 5/48

ANALYSIS OF THE WING LEADING EDGE

The leading edge loads are directly proportional to the gross weight of the airplane and since the B-36A and the XB-36 leading edge structures are similar it will not be necessary to make a detail analysis of the XB-36 leading edge. The loads on the XB-36 leading edge will decrease from the loads on the B-36A (Ref. FES-36-142, page III-428) by the ratio of their gross weights,  $265,192/277,000 = .955$ , and the margin of safety of B-36 (Ref. page III-486, FES-36-142) will increase by 4.5% for the XB-36 leading edge margins of safety.

The minimum margin of safety for the B-36 leading edge structure exists in the diagonal tube of a typical leading rib, wing station 127.16

$$M.S.(B-36A) = 0 \quad (\text{Ref: FES-36-142, P. III-486})$$

$$M.S.(XB-36) = 1.045 \times 1 - 1 = +.045$$

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CONSOLIDATED VULTEE AIRCRAFT CORP., FORT WORTH DIV.,  
TEX. (REPORT NO. FZS-36-242)

STRESS ANALYSIS OF WING CENTER SECTION - PART III - INTERSPAR  
BULKHEADS - LEADING AND TRAILING EDGE STRUCTURE - MODEL XB-36

N.S. MEFFORD; B.C. VOSS; A.B. CANFIELD AND OTHERS  
MAY 1948 306PP. TABLES, GRAPHS

USAF CONTR. NO. W535-AC-22352

STRUCTURES (7) WINGS - STRESS ANALYSIS  
DESIGN AND DETAILS (3) B-36 - STRESS ANALYSIS  
B-36

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